FOUNDRY TRADE JOURNAL

EST. 1902

WITH WHICH IS INCORPORATED THE IRON AND STEEL TRADES JOURNAL

VOL. 102
No. 2102
Registered at the G.P.O. as a Newspaper

JANUARY 24, 1957
Offices: John Adam House, John Adam St., London, W.C.2

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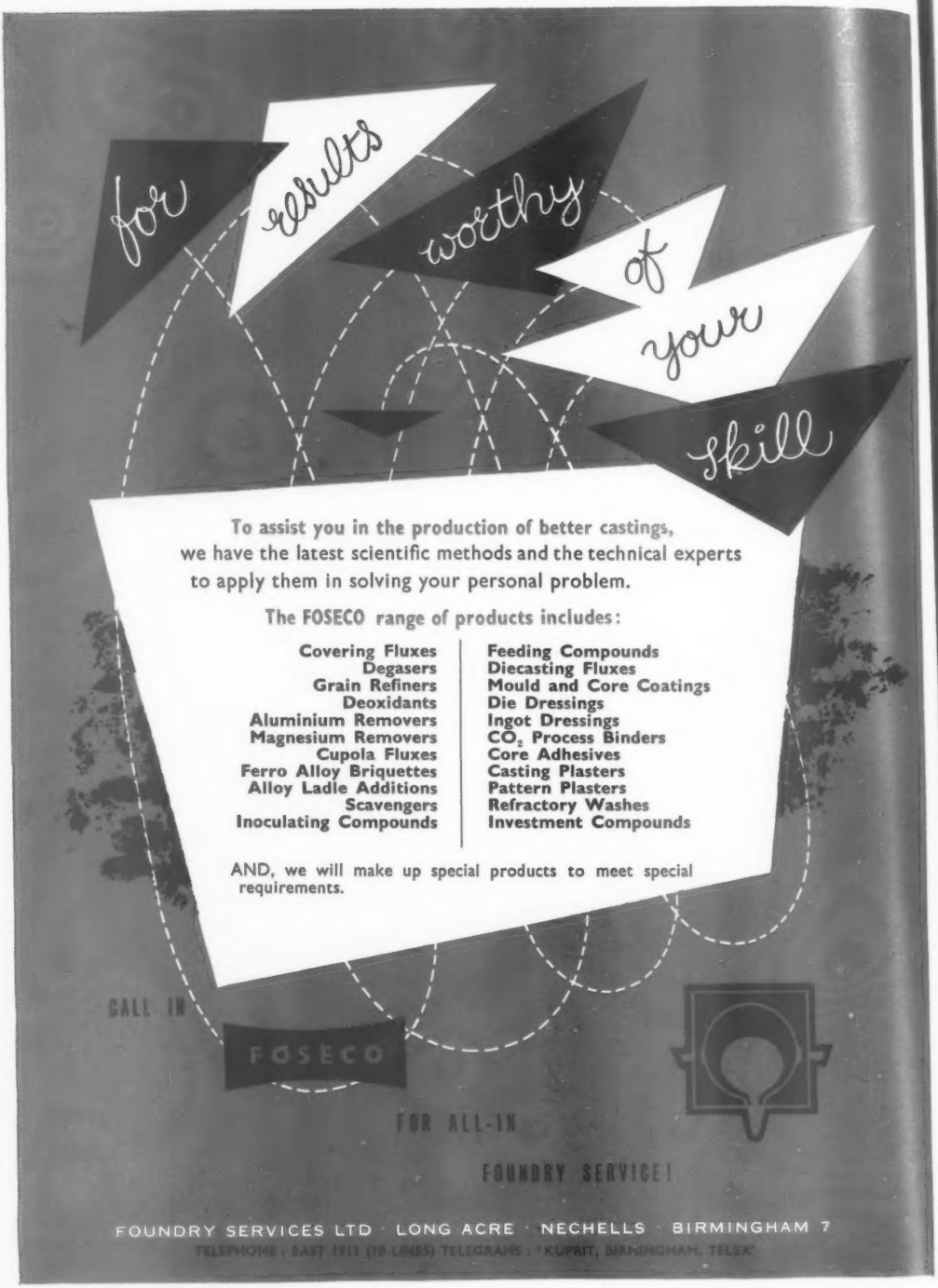
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FOUNDRY TRADE JOURNAL

Established 1902

Vol. 102 | Thursday, January 24, 1957 | No. 2102

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AN INDUSTRIAL NEWSPAPERS PUBLICATION

Published Weekly

Single copy 9d.; by post 1s.

Annual subscription : home 40s., abroad 45s. (prepaid).

17/19 JOHN ADAM STREET, ADELPHI, LONDON, W.C.2

'Phone: TRAfalgar 6171 (10 lines)
'Grams: Zacatecas, Rand, London

Gas at Work

"Gas at Work in Industry" is the title of an exhibition now running at the Horticultural Hall in London. It is organized by four of the South of England Gas Boards and its significance can be assessed from the statement that despite the fact that there are 40,000,000 domestic consumers of gas, the industrial load accounts for one-third of the total production. We believe that the foundry industry ranks amongst the important users of gas. In a small foundry we visited only last week, gas was being extensively used for core baking and skin drying of moulds. Again, much of the plant displayed at the exhibition was the product of our advertisers, and it is shown as being applied to metal melting, die-casting, shell moulding and heat-treatment.

A "new look" is given to this exhibition, as space has not been allocated to particular firms but to specific industrial applications, such as space heating, heat-treatment, and so forth. This arrangement—for some reason we cannot quite pinpoint—has made for a more artistic appearance. It may be that in the conventional exhibitions, composite displays of moulding machines, cupolas, and moulding boxes have to sacrifice symmetry for utility. There is one factor in the present exhibition which we consider to be a psychological drawback, that is, each area is totally enclosed and entered by a gate, and, ridiculously, one hesitates to open a gate, as subconsciously one imagines one should examine the exhibits from the gangways. The decor and lighting are of the highest order, and taking into consideration that the hall was only made available on the Thursday prior to the opening on Monday, great credit is due to those responsible for the preparation—especially in the equipment-manufacturers' section.

The foundry industry is devoting much thought at the present time to an exhibition policy, and amongst the most important questions is the acquisition of a hall. At the moment in London, there are, in addition to this exhibition, two others running, covering furniture and packaging at Earls Court and Olympia, respectively, and this merely typifies what is happening throughout the year. The "Gas in Industry" exhibition continues through next week and, the intrinsic merits of the exhibits apart, we suggest that those important people who are being called upon to formulate a foundry-exhibition policy should, if at all possible, visit the Horticultural Hall and perhaps one of the other exhibitions, too. This would enable them to make up their minds what kind of a show they hope to stage. Unless there can be generated a real enthusiasm for a project—of the sort which was evinced at Sheffield, and which has obviously animated the Gas Boards—then the sponsors will only be wasting their time.

Firth's Buy Beardmore's

William Beardmore & Company, Limited, forgemasters, of Parkhead, Glasgow, have been taken over by Thos. Firth & John Brown, Limited, of Sheffield, who have acquired the whole of the issued capital of four million ordinary shares of £1 for £3,650,000. Of this, £2,000,000 has already been paid, and the balance is due for settlement within a year. The Parkhead works of Beardmore's cover some 62½ acres, where the company melt alloy and carbon steels and convert them into castings and forgings for the shipbuilding, marine, electrical, and general engineering industries.

Among Beardmore customers are the Admiralty and Ministry of Supply, the Atomic Energy Authority, as well as many of the leading UK concerns in electrical and general engineering. Firth & Brown state that, while there will be some rationalization of the manufacture now carried out both in Glasgow and Sheffield, it will result in an increase in the overall capacity of the new groups; some integration of the businesses is desirable, they add, but it is intended that Beardmore's will continue to run on much the same lines as at present. Some months ago, it will be recalled, Beardmore's announced a development programme. Costing over £1,500,000, it would replace the existing open-hearth furnaces with electric arc furnaces with a consequent increase in steelmaking capacity of about 30 per cent. Firth & Brown state that their own and the Beardmore development programme will be reviewed with a view to discovering how much new capital they will require to raise from their shareholders.

Present Position

The latest available accounts of Wm. Beardmore & Company, issued by the Iron and Steel Holding & Realization Agency, show that for the year to October 1, 1955, the consolidated net profit, after tax, was some £348,000, compared with £153,000 in the previous year. The group balance-sheet—which takes in Glasgow Railway Engine and Dalmuir & West of Scotland Estates Company, shows total assets of some £5,937,000 at that date, of which £1,740,000 represented net fixed assets, £3,078,000 current assets, and £1,119,000 sums due from ISHRA and other companies in the agency. Mr. John G. Girdwood has resigned as chairman and director of Beardmore's and will be succeeded by Sir John Green, chairman of Firth & Brown. Mr. Girdwood's connection with Beardmore's began in 1913, his father, Mr. David Girdwood, having started his career with the firm in 1876 on the same day as the late Lord Invernairn, then William Beardmore. Mr. John Girdwood joined the management board in 1918 and became a full member of the board in 1925. He resigned in 1928 but rejoined the board in 1945. He became deputy chairman in 1951 and chairman in 1954. Beardmore & Company were nationalized along with other steel undertakings in 1951 and their regular capital has recently been held by ISHRA.

Monopolies Commission Membership

It is announced by the Board of Trade that Mr. Andrew Black, C.B.E., has been appointed to the Monopolies Commission for a period of three years; his appointment took effect on December 24, 1956. The membership of the Monopolies Commission is now as follows:—Mr. R. F. Levy, Q.C. (chairman); Professor G. C. Allen; Sir Thomas Barnes, G.C.B., C.B.E.; Mr. J. A. Birch; Mr. Andrew Black, C.B.E., A.S.A.A.; Mr. Brian Davidson; Dr. L. T. M. Gray; Mr. I. C. Hill; and Sir Frank Shires.

"Gas at Work in Industry" Exhibition

The "Gas at Work in Industry" exhibition which opened at the Horticultural Hall, Westminster, on Monday, has already been visited by many representatives of the foundry industry. Two stands of special interest are those exhibiting metal melting and shell moulding. A die-casting machine, together with various furnaces, including bale-out, crucible, reverberatory; and lip-axis tilting furnaces are being demonstrated, the diecasting unit being operated in conjunction with one of these furnaces. The shell-moulding stand shows the technique of the production of the moulds, and consists of a shell-moulding machine and a sand mixer, both of proved design. It is made clear how this relatively new process, which gives promise of increased efficiency, by better surface finish and more consistent quality and mechanical properties, is making rapid progress.

Other stands of subsidiary interest to founders are those exhibiting heat-treatment ovens and furnaces; convection and radiant heating; space heating; industrial burners; flame processing and control and instrumentation devices. An unusual feature is the grouping of the exhibits under the various applications rather than under the individual manufacturers.

Loan Facilities for Small Manufacturers

Three years ago a £700,000 Revolving Loan Fund for Industry was established, as a part of the Conditional Aid programme, for the purpose of increasing productive efficiency in industry. The fund provides short-term loans to enable suitable small manufacturers to buy up-to-date equipment and adopt modern techniques.

The Board of Trade state that increases in production and substantial savings in labour and material have been reported by firms who have been able to improve efficiency as a direct result of assistance from the fund. The major part of the fund has been issued or is under negotiation but as it operates on a revolving basis the amount available for further loans is continually being supplemented as repayments are made and the Board of Trade are ready to consider further applications. Further details can be obtained from the Board of Trade, I.M.2 Division (Revolving Fund for Industry), Horse Guards Avenue, London, S.W.1 (telephone: TRAfalgar 8855, Ext. 2382).

Rating of Firms' Sport Clubs

A rating point which affects foundries owning sports grounds for the use of their employees was decided at the Surrey Quarter Sessions recently. The case arose when Esher Council refused to grant to the Distillers' Sports Club partial exemption from rates, which can be claimed under the Rating and Valuation (Miscellaneous Provisions) Act, 1955, for playing fields occupied by a non-profit-making organization purely devoted to sport. The Club which existed for the employees of the Distillers' Group of Companies, was occupied under licence from the firm which could be terminated at any time, and the Council claimed from the Club about £600 a year as against £341 paid last year. The ground was owned by the Distillers' group, and no charge was made to spectators for admittance to the playing fields. The Club appealed to quarter sessions under the Poor Relief Act, 1743, which provides for such an appeal by a ratepayer aggrieved by any rate made for the relief of the poor, and the appeal was allowed.

Crucible Melting—Review of the Present Stage of Development*

By D. W. Brown, B.Sc., F.I.M.

MR. BROWN joined the Morgan Crucible Company, Limited, in 1933, and is now employed in the crucible technical department. Born in 1915, and educated at Alleyns School, Dulwich, he studied fuels, refractories and foundry practice at the Sir John Cass Technical Institute, and later, engineering and metallurgy at this Institute and at the Battersea Polytechnic. He was awarded the J. Stone prize in foundry practice in 1936, and a B.Sc. in metallurgy of London University in 1946.

This review will be limited to the melting of aluminium and copper-base alloys for the production of foundry castings. Crucible furnaces are usually divided into classes according to the method of pouring the metal from the crucible, as follow:—(1) *Lift-out furnaces, in which the crucible is removed from the furnace and carried to the moulds for pouring the metal;* (2) *bale-out furnaces in which the metal is ladled out from the crucible into the moulds and* (3) *tilting furnaces which may either be central-axis type or lip-axis. With lip-axis furnaces, the pouring point remains constant so that it is not necessary to move the ladle during the pour. In suitable circumstances, the metal can be poured from the furnace direct into the moulds. All these furnaces can be fired by fuel oil, coke, gas or electricity. Electric heating may either be by resistance or induction.*

Types of Furnaces

Lift-out

Lift-out furnaces are commonly used in capacities from about 60 to 350 lb. and have the advantage of extreme flexibility both as regards the alloy melted and the quantity. Different crucibles can be used for different alloys so as to avoid contamination and to some extent, crucibles of different sizes can be employed in the same furnace to suit the production required. However, these furnaces are somewhat limited in capacity as it is usually considered dangerous to lift out very large crucibles and carry them about the foundry. In some cases, crucibles having an aluminium capacity as great as 400 lb. have been used in such furnaces and the advantage is claimed that the metal is subjected to the least possible amount of disturbance and splashing in transfer from the melting unit to the actual mould. In general, lift-out furnaces find their main application in jobbing foundries where their great flexibility is of considerable advantage.

Bale-out

Bale-out furnaces are employed where small quantities of metal are required at frequent intervals as in die-casting foundries. They may be used for holding or maintaining molten metal only, but in some cases, the main melting is also carried out in the bale-out furnaces. For melting, their thermal efficiency is rather low—particularly on high-temperature work—but they do provide a small self-contained unit which will handle a variety of work.

Tilting

Tilting furnaces are mainly employed where a comparatively large output of any particular alloy is needed. The metal is transferred to the mould in a ladle or in a pre-heated lift-out crucible. These furnaces are made in sizes up to about 1-ton bronze or ½-ton aluminium-alloy capacity although the most popular sizes are of about ½-ton bronze capacity.

Scope of Large Tilting Furnaces

All crucible furnaces, like other plant, run most efficiently when they can be run continuously for long periods, but this applies particularly to the large tilting furnaces. If such furnaces are run very intermittently, a considerable amount of heat is wasted in heating up the furnace lining whilst at the same time, the crucible life is usually reduced due to the thermal strains which are almost unavoidable when heating up a large one-piece article. Some progress has been made by crucible manufacturers in recent years in dealing with this problem. Large clay-bonded, plumbago crucibles are now available having thinner walls and made in improved material. The thinner walls give improved resistance to thermal shock, greater capacity and better heat-transfer. In addition, carbon-bonded, silicon/carbide plumbago crucibles are available which have an inherently improved resistance to thermal shock and temperature strains so that they are more suitable for intermittent work, whilst the thermal conductivity of these latter crucibles is also being improved to assist quicker melting.

Supercharge Pre-heating

There are two ways in which crucible furnaces can be designed and used, which may be known as

*Paper read at a symposium on "Foundry Melting Practice," organized by the *Association Technique de Fonderie de Belgique*, at Ghent University.

Crucible Melting

the " closed-crucible method " and the " supercharge pre-heating method "—called " S.P. " for the sake of brevity. In the closed-crucible method, the furnace is so designed that the products of combustion are completely excluded from the molten metal by the crucible itself. Fig. 1 illustrates a tilting furnace of this type in which the tall crucible (known as the " pour-over-the-top " type) extends right through the furnace cover so that the products of combustion cannot enter the crucible. A similar effect can be obtained with the spouted type of crucible provided it is properly sealed to a muffle ring and a spout cover is employed to exclude flame. These designs probably provide the best metallurgical condition in melting, as the metal can be kept under reducing or oxidizing conditions as required, irrespective of the oxidizing or reducing nature of the flame. Thus, the closed-crucible method is recommended for the difficult alloys, particularly where gas or sulphur pick-up must be carefully avoided.

The supercharge pre-heating method allows the products of combustion to come into contact with the unmelted metal in the upper part of the crucible or in the muffle ring above, so as to improve thermal efficiency and provide more rapid melting. Crucible lift-out furnaces are usually of this type and most tilting furnaces can be employed " S.P." or " closed " as required.

Fig. 2 illustrates how ports may be cut in the back of a " pour-over-the-top " crucible in order to allow flame contact with the supercharge which usually results in an improvement in melting time of about 20 per cent. with a corresponding saving in fuel. Fig. 3 shows a similar arrangement with a spouted crucible using a slotted muffle ring. In some cases, crucible life has also been considerably improved on changing over from the closed-crucible method. At first sight, it might be thought that metal losses would be considerably increased by allowing the flame into the crucible, but in practice, the difference is quite small, as will be shown later in the Paper. The flame is only in contact with solid metal in the upper part of the crucible where the temperature is comparatively low and as the metal in the hot zone at the bottom of the crucible melts, the charge sinks down within the protection of the crucible walls. When all is melted, only a small melt surface is exposed to the atmosphere. This method of melting is quite different from that in a reverberatory furnace where the molten metal bath has a large surface-area and shallow depth and has the flame playing directly upon it.

The " S.P." method of melting should not be employed where small scrap or swarf is being melted which might fall through the gaps or flame ports and fall into the combustion chamber. This would not only waste metal but would also cause rapid wear to the furnace lining refractories. With this reservation, the " S.P." method is recommended for all general foundrywork, particularly when the gas content of the melt is not critical or where efficient degassing methods are being employed. It may be unwise to use this method for brasses containing more than 20 per cent. of zinc, since there is a tendency to increase the loss of zinc by volatilization. Similarly, with copper/lead alloys containing 30 per cent. lead, there may be more tendency for the lead to segregate and the closed-crucible method may be advisable.

Melt Quality

Providing the rules of good melting practice are followed, there should be no difficulty in obtaining metal of excellent quality from crucible furnaces. Contamination from one charge to the next can easily be avoided since even if it is wished to retain the same crucible, it is easy to scrape out the smooth one-piece crucible—there are no joints to retain metal from a previous charge. The metal melts from the bottom upwards, so that the solid metal above sinks down into a molten pool and local overheating of any portion of the charge is avoided. For difficult work where the closed-crucible method is used, it is possible to protect the metal completely from the products of combustion. This has been established by some tests in which gas analysis of the combustion gases leaving the exhaust ports of the furnace and analysis of the gas immediately over the metal surface were carried out. Typical results are shown in Table I.

TABLE I.—*Gas Composition at Various Points (per cent.).*

—	CO_2	O_2	CO
Exhaust gas during melting	14.8	nil	1.4
Gas in crucible over metal whilst melting, no cover on the crucible or the metal..	0.5	19.0	0.0
Gas in crucible over metal with charcoal cover on the metal	5.0	0.0	16.0

The question is often asked whether the metal is liable to be contaminated by gas passing through the crucible wall and dissolving in the melt. It must be admitted that the crucible itself, though of close texture, is permeable to gases, whilst the glaze on the outside of the crucible is impermeable. It is appreciated that the glaze may be damaged whilst the crucible is in use, thus rendering possible the passage of gas through the crucible wall. However, it is considered that the contamination of the melt in this manner is most unlikely in practice for the following reasons:—

The products of combustion in a crucible furnace operated with a neutral, slightly oxidizing, or slightly reducing flame, may contain carbon monoxide, carbon dioxide, water-vapour and oxygen. If the flame is really oxidizing, there will be little or no carbon monoxide whilst if it is reducing, there will be little or no oxygen. The proportions of the gases will depend on the nature of the fuel. Free hydrogen will not be found in the combustion gases except perhaps immediately in front of the burner in gas-fired furnaces and possibly also in coke furnaces operated with wet coke and a poor draught.

Metal and Crucible Reactions

It is generally agreed that molecular hydrogen is not the most important source of contamination

TABLE II.—*Approximate Gross Losses in Melting* 85/5/5/5 *Gunmetal in Tilting Furnaces,* 650 *lb. Capacity (per cent.).*

Stage.	Losses under conditions (for details see footnotes).				
	(1) (Closed, charcoal.)	(2) (S.P., charcoal.)	(3) (S.P.)	(4) (Closed.)	(5) (Closed, flux.)
From charging until an unbroken melt surface	¼	¼	1	1¾	1¼ to 2
From stage (*b*) to 1,200 deg. C. in, say, 15 min.	¼	¼	¼	¼	¼ to ½
Stewing at 1,200 deg. C. for ½ hour	Under ¼	¼	¼	¼	¼
Stewing at 1,250 deg. C. for ½ hour	¾	1	1	1	¾
Total losses pouring at 1,200 deg. C. without stewing	½	¾	1½	2¼	1¾ to 2½
Total losses pouring at 1,200 deg. C. with ½ hour stewing at 1,200 deg. C.	½ to ¾	1	2	2½	2 to 2¾
Total losses pouring at 1,250 deg. C. with ½ hour stewing at 1,250 deg. C.	1¼	1¾	2½	3¼	2½ to 3¼

(1) Reducing conditions—adequate charcoal cover, "closed" crucible.
(2) S.P. conditions—neutral flame, charcoal cover.
(3) S.P. conditions—neutral flame, no cover.
(4) Oxidizing conditions—"closed" crucible, no cover.
(5) Oxidizing conditions, flux cover "closed" crucible. The lower result is intended to refer to neutral fluxes and the higher result to oxidizing fluxes.

of molten metal but the usual cause is that water vapour comes into contact with the metal and reacts with it, forming the metal oxide and hydrogen which is nascent and is readily dissolved in the metal.

The graphite in the crucible will be oxidized by contact with oxygen, water-vapour or carbon dioxide. If any of these gases are able to penetrate the crucible wall due to its permeability, some oxidation of the graphite in the crucible will occur. If water-vapour penetrates the crucible wall, it will react with the plumbago, forming carbon monoxide and hydrogen and the hydrogen might continue to penetrate into the crucible and ultimately reach the metal:—

$$H_2O + C = H_2 + CO$$

It can be seen that any penetration of hydrogen in this manner would also be accompanied by oxidation of the crucible material but, on the other hand, all oxidation of crucible graphite is not necessarily accompanied by penetration of hydrogen, since other gases such as carbon dioxide and oxygen can cause such oxidation of graphite without giving any possibility of hydrogen pick-up by the metal. In fact, the red-hot crucible is always exposed to an oxidizing atmosphere when the burner is turned off at the end of a melt and in practice, much of the oxidation may occur then. Moreover, even if any oxidation occurring is caused by the decomposition of water-vapour in combustion gases as indicated above, the hydrogen is in the molecular form and still has to pass through the remainder of the crucible wall and may well be stopped by the glaze on the inside of the crucible whether this be a glaze applied in manufacture, or a layer of glassy slag formed in use.

Thus, it can be seen that complete penetration of the crucible by appreciable quantities of hydrogen can only have occurred when the crucible shows fairly severe oxidation whilst even when such oxidation is present, it does not prove that hydrogen in fact has passed through the wall.

Crucibles have been developed so that even if the glaze is damaged or flaked off, the surface so exposed, readily reglazes and this again forms a considerable barrier to the penetration of hydrogen. The fact that crucibles used for melting copper alloys seldom show any oxidation during use, suggests that penetration of the crucible by hydrogen does not commonly occur when melting these alloys. With aluminium alloys, oxidation of the crucible is more often seen but it is believed that most of this occurs when the burner has been turned off as indicated.

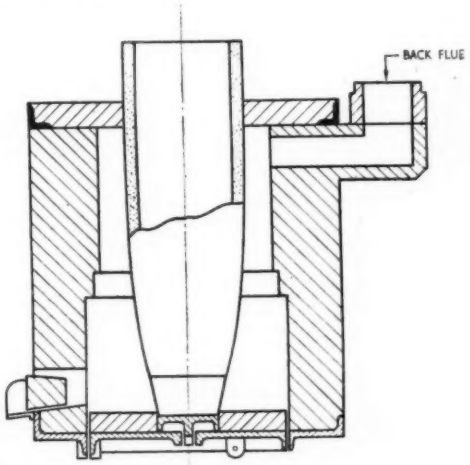


FIG. 1.—*Tilting furnace with "pour-over-the-top" crucible and back flue. The tall crucible extends right through the furnace cover thus preventing the products of combustion from entering the crucible.*

There are many sources from which hydrogen can be picked up during melting but, undoubtedly, the most important of these is from water-vapour which may be present in the foundry atmosphere or may come from unburnt refractories in contact with the metal. In a crucible furnace, there is no unfired ramming or setting material in contact with the metal but care must be taken to see that the metal does not run over unfired material in the spout of the crucible furnace. If this spout has to be "made up" when setting the crucible, care should be taken that this material is well fired out before the first charge is poured over it.

Crucible Melting

Metal Losses

With the present high prices for non-ferrous metals, metal losses during melting are of great importance. Indeed, the cost of metal loss can exceed the cost of fuel, labour and refractories added together. In the last year or two, the Author has been concerned in a considerable amount of experimental work intended to show the extent of metal losses which occur when non-ferrous alloys are melted in crucibles and to find how melting conditions can be controlled to minimize the losses. Some of this work has been carried out

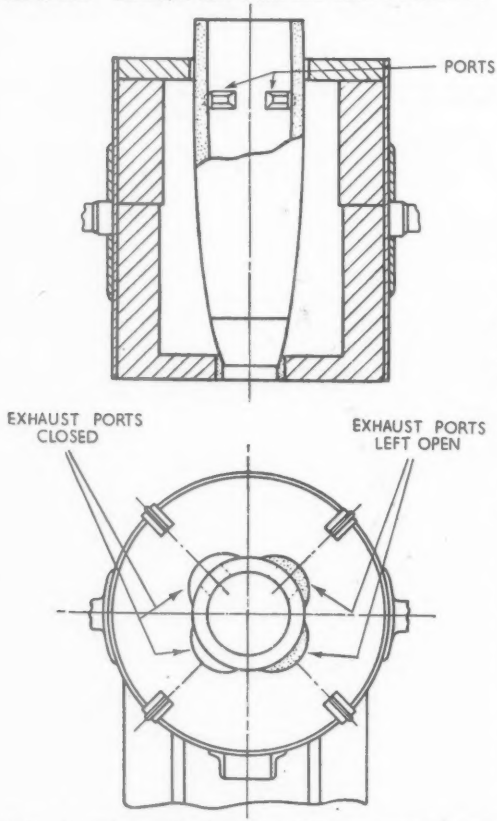


FIG. 2.—*Plan and elevation showing supercharge pre-heating with a "pour-over-the-top" crucible. The diagram illustrates how ports may be cut in the back, allowing flame contact with the supercharge.*

in conjunction with the British Non-Ferrous Metals Research Association, who will be publishing a detailed report in due course, but some of the conclusions can be given now.

The most complete programme of work has been carried out with gunmetal LG_2 85/5/5/5, but, other tests have been carried out with gunmetal LG_3 86/7/5/2, brass B3 .65/35, manganese bronze HTB_2 and phosphor bronze PB1 90/10 and aluminium alloy DTD 424. Experiments were carried out to show the effect of carelessness in working the furnaces and also to show the effect of charcoal covers, flux covers, nitrogen degassing and flame contact with the supercharge (S.P. melting).

The following conclusions relate primarily to gunmetal except as otherwise stated. So far as losses are concerned, the melting process can be divided into the following stages:—

(*a*) charging the crucible;

(*b*) from the commencement of firing until no solid metal remains above the melt surface;

(*c*) heating from stage (*b*) to normal pouring temperature, say 100 deg. C. above the liquidus temperature;

(*d*) maintaining pouring temperature for a period;

(*e*) superheating to a high pouring temperature say, 200 deg. C. above the liquidus;

(*f*) skimming and pouring.

Naturally not all these stages are involved in every case.

(*a*) *Loss in charging* depends entirely on the care taken by the operator. It is not usually significant when ingot or large scrap is being melted but when small scrap or turnings are employed, there is a danger that some of this material will find its way into the combustion space if the operator is careless. This is scarcely possible when the closed-crucible method is employed with a pour-over-the-top crucible in a back-flue furnace or when a bale-out furnace with a back flue is used, but in other cases, the foundry foreman should be well aware of this danger, as it not only wastes metal but also reduces the life of the furnace refractories.

(*b*) *Melting down.* In this stage, the loss is controlled by the area of metal surface exposed and by the ability of the atmosphere in contact with the metal to oxidize it. The loss may be highest when the closed-crucible method is employed and no steps are taken to prevent air from circulating in the crucible. In this case, there is an ample supply of oxygen and as much as 2 per cent. loss in a gunmetal can take place when scrap, having a large surface-area: weight ratio, is melted. S.P. melting reduces the loss by reducing the amount of oxygen available whilst the use of charcoal considerably reduces the loss in all copper alloys. Flux is of little use until the metal has melted.

(*c*) *Heating to pouring temperature.* The loss at this stage is nearly always quite low since the amount of metal surface exposed is small and it is usually covered with a thin layer of oxide which reduces further action. Again, the use of a charcoal cover is effective in minimizing loss.

(*d*) *Maintaining temperature.* Generally, the loss is very small except in alloys containing an appreciable amount of zinc where loss by volatilization of zinc is cumulative. A charcoal cover is of little use in reducing volatilization loss but suitable flux reduces the loss considerably.

TABLE III.—*Test Carried Out on Gas-fired Bale-out 330-lb. Furnace.*

Experimental Details.

	Time.	Reading, cub. ft.	Using, cub. ft.	Remarks.
Light up—air pressure, 6 in water gauge	8.13	26,985		
10 in. „ „	8.23			
15 in. „ „	8.33			
Time of charging, 15 in. water gauge	8.43	27,380	395	30 mins.: warming.
22 in. „ „	8.50			
First heat ready	10.30	29,270	1,890	1 hr. 47 min. 1st heat.
Baling commenced	10.40	29,270		
First hour baling	11.40	29,935	665	1st hour }
Second hour baling	12.40	30,520	585	2nd hour } Baling out.
Third hour baling	1.40	31,070	550	3rd hour }
Fourth hour baling	2.40	31,630	560	4th hour }
Crucible empty	3.40	31,645	15	Maintaining temp. 720 deg. C.

Fuel Consumption.

	Total gas, cub. ft.	Gas per 100 lb., cub. ft.
For 1,020 lb. cast	4,645	455
For 720 lb. continuous melting	2,360	328
For 540 lb. continuous melting (last 3 hours)	1,695	314

Gas for 1 hour's maintaining—15 cub. ft.
Metal. Initial weight—480 lb. 1st charge—300 lb.

Metal-loss Figures.

	Total.	Added flux.	Recovered.
Skimmings, Ladle dross	2 lb. 1 oz.	7 oz.	3 lb.
Floor sweepings	12 oz.	1 oz.	1½ lb.

	Total (lb.).	Loss (lb.).	Per cent.
Ingot cast	474½	5½	0.54 (gross loss)
Ingot cast plus sweepings	476	4	0.40 (gross loss)
Ingot cast plus sweepings, ladle dross and skimmings	479	1	0.1 (nett loss)

Total flux used—2 lb.; dross remaining—2½ lb.; gas—500 B.T.U. per cub. ft.

(*e*) *Superheating.* At this stage, volatilization of zinc becomes the most important factor with alloys containing more than 2 to 3 per cent. of this constituent. Brasses containing 30 per cent. zinc or more may well commence to boil when loss will be quite heavy and progressive with time. Again, fluxes are useful but if the metal boils, even a thick flux cover becomes ineffectual.

(*f*) *Skimming and pouring.* The loss on skimming can be quite important since quantities of metal are easily skimmed off with the dross or slag, especially if there is an appreciable amount of slag or flux on the melt. It was found necessary in the experimental work to distinguish between metal lost by oxidation or volatilization and metal entrained in slags and removed with skimmings or spilt during pouring. The method employed was to remelt all skimmings in a small crucible with a little flux and weigh the metal so recovered from them. The difference between the weight of metal charged and the weight of metal actually cast was called the "gross loss" and the loss when the amount of metal recovered from the skimmings was taken into consideration was called the "net loss." It was found that the net loss was generally only 50 to 60 per cent. of the gross loss and this suggests that it would often pay the foundryman to give more attention to skimming and to use a simple recovery method to remove the bulk of the metal trapped in skimmings and drosses.

Table II shows the approximate gross losses in melting 85/5/5/5 gunmetal in tilting crucible furnaces under various conditions divided into stages as indicated above.

Other Alloys

So far as alloys other than gunmetal are concerned, it was found that when melting brass 65/35 and pouring at 1,080 deg. C., the gross loss was about 2½ per cent. (net loss 1¾ per cent.) when the closed-crucible method without any cover was employed and that these losses could be reduced to 1 per cent. gross and ¼ per cent. net respectively by the use of a charcoal cover. With high-tensile brass (manganese bronze), the losses were about the same as for brass but in this case, a flux cover was found very effective and reduced the losses to ½ per cent. gross and ½ per cent. net approximately. With phosphor bronze, the losses were always low and only exceeded ½ per cent. if an oxidizing flux was used. Nitrogen degassing had a negligible effect on metal losses.

It can be seen that if the metal is melted under charcoal, a considerable economy in metal loss can be made. The use of charcoal was at one time very popular in the copper alloy foundry but more recently, much attention has been given to the advantage of oxidizing conditions in reducing the gas content of the melt. It can be seen that the use of oxidizing conditions can involve an extra cost of about £5 per ton of metal melted (an extra

Crucible Melting

1½ per cent. loss at £335 per ton) and now that nitrogen degassing is available as a simple means of removing the dissolved hydrogen from molten metal where desirable, it seems that the use of oxidizing conditions can seldom be justified. Fig. 4 shows these results diagrammatically.

So far as metal losses when melting aluminium alloys are concerned, the work was carried out in a bale-out furnace holding 300 lb. of metal. The experimental procedure was to melt a full charge of metal in the furnace and then bale out continuously at a rate of 160 lb. per hour keeping the bath at a substantially constant level by additions of cold metal. The metal temperature was controlled between 710 and 730 deg. C. throughout and all the metal added to the furnace and cast from it was weighed during the day. At the end of four hours' casting, the temperature was maintained for a further one hour without casting and then the basin was baled empty. The total weight cast was added up and the total weight of the skimmings was noted. It was found that the metal loss was mostly in the form of metal entrained in the skimmings and that it could be minimized by the careful use of a small quantity of flux every time the furnace was skimmed—only a few grammes of flux scattered over the surface and stirred in, with a minimum of disturbance of the melt, was necessary. In this way it was found that the total gross melting loss could be kept down to about ½ per cent. of the total metal melted and that about half of the missing metal could be recovered from the skimmings and spilt metal by remelting them with flux. Table III shows the details of a typical day's work.

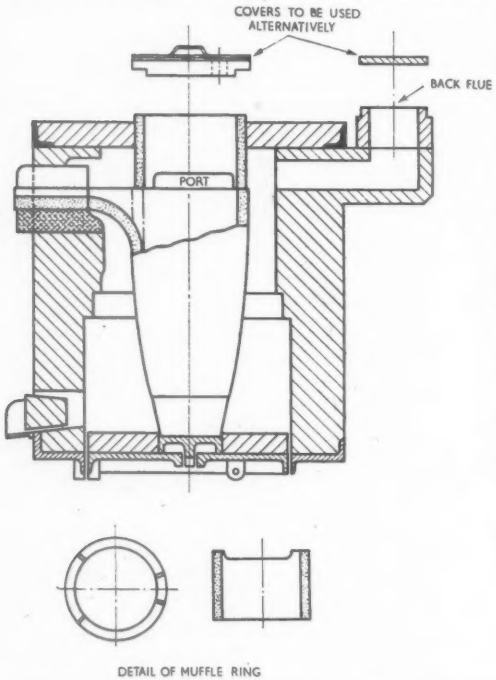


FIG. 3.—*Supercharge pre-heating method, using a spouted crucible and muffle ring.*

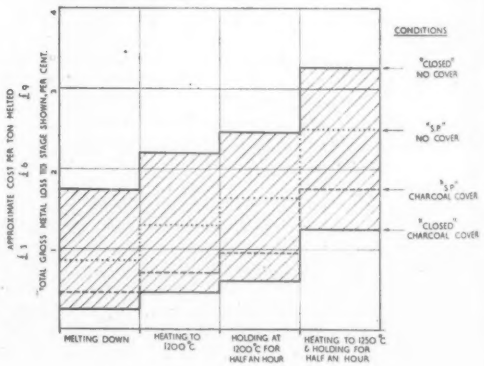
Present and Future Developments

In the last 20 years, a considerable amount of development work has been carried out particularly with a view to increasing output, fuel economy and convenience of working furnaces. Similarly, considerable improvements have been made in the crucibles themselves and it is interesting to note that the cost of crucibles, per ton of metal melted, is now very similar to what it was 50 years ago, in spite of the considerable all-round increase in prices in the meantime.

Experiments with pre-heated air have generally been disappointing. With simple inexpensive pre-heaters, the gains in fuel economy and melting times have been quite negligible. Higher pre-heating temperatures involve large and elaborate recuperators of equal bulk and cost to the crucible furnace itself and moreover, low-pressure air-burners cannot be used with air temperatures over about 200 deg. C. Air pre-heats of this order have shown very little gain in output or fuel economy whilst the increase in maintenance cost has rendered the process uneconomical. Still higher air temperatures would involve the use of medium-pressure air-burners in which the bulk of the air for combustion does not pass through the burner. These again are more expensive and involve the use of a compressor.

Crucible furnaces have now reached an advanced state of development and there is little scope for any marked advance on modern designs. Most development work is now directed to improving the working conditions, ease of control and con-

FIG. 4.—*Diagram showing (by cross-hatched areas) the saving made by the use of charcoal when melting "closed."*



venience of operation of the furnaces. In particular, back-flue furnaces are now being more widely employed to avoid exposing the furnacemen to the heat of the exhaust flame. Such furnaces are particularly useful for die-casting work and for any other operation which involves the furnaceman having to "work" the metal, that is, to make additions of alloying elements, deoxidizers or fluxes which have to be thoroughly stirred into the melt. Such back-flue furnaces are usually worked "closed" but it is possible to apply a certain amount of "S.P." by using flame ports of restricted area into the crucible and partially blocking the back flue during the melting-down period. When the metal is all molten, the cover on the back flue is removed and a cover is placed on the crucible itself instead. This crucible cover is removed when additions have to be made to the melt but even so, most of the flame then leaves by the back flue.

In die-casting foundries, the question is often raised as to whether it is better to melt and maintain in the same unit or whether it is better to employ a bulk-melting furnace in conjunction with several maintaining furnaces. The former method probably gives the best fuel economy but the latter method, with maintaining furnaces, gives much improved flexibility and more scope for dealing with alloys which have to be modified or otherwise treated. It is possible to make considerable improvements in the maintaining furnaces if they are limited to this work only and are not made capable of melting as well. In the case of bale-out crucible maintaining furnaces, there is considerable scope for improving insulation, especially with hot face insulating bricks on the inner surface, so as to obtain fuel economy and a lower casting temperature giving better working conditions. The heat input can be arranged to be little more than that necessary for maintaining temperature in the furnace. It is then comparatively easy to arrange for automatic temperature control, particularly when using gas or electric heating, to give more accurate regulation of temperature than can be obtained by manual control with the average furnace operator. Moreover, the diecaster is able to proceed with casting without having to interrupt his work to adjust the burner. The fuel consumption for maintaining temperature is not excessive; for example, an electric resistance bale-out furnace of 300 lb. aluminium capacity, will maintain a full charge at temperature with a consumption of about 9 kw.

Conclusion

Summing up, one may say that crucible furnaces have a wide field of application in the copper-alloy and aluminium-alloy foundries. They have the advantage that the capital cost is moderate so that amortization and interest on capital is low. Maintenance work is comparatively simple and it can be carried out by the ordinary fitter and bricklayer without the assistance of any specialized personnel. Providing good melting practice is followed, metal of excellent quality is produced and metal losses are low. In particular, crucible furnaces have that high degree of flexibility which is most important in the average foundry.

RTB Output Records

Figures released by Richard Thomas & Baldwins, Limited, Ebbw Vale, show that the outputs of iron, steel, and tinplate in 1956 were again higher than ever before. Pig-iron output totalled 557,115 tons, which was over 100,000 tons more than in 1955. In both the Bessemer and open-hearth steelmaking departments substantial increases were achieved. The combined output of the two departments was 694,175 ingot tons, an increase over the 1955 figure of 46,155 tons.

Production of hot-dipped and electrolytic tinplate totalled 3,856,964 basis boxes, against 3,738,098 basis boxes in 1955. New records were set up by the coke ovens, slabbing mill, and hot-strip mill. The coke ovens produced 479,069 tons (463,759 tons in 1955); the slabbing mill rolled 669,668 (630,102) tons, and the hot-strip mill 808,091 (785,755) tons.

The company's quarry at Ystrad (Breconshire) provided 364,758 tons of limestone to the Ebbw Vale works, surpassing the 1955 total by 25,323 tons, and the basic-slag department, where Bessemer slag is ground into agricultural fertilizer, exceeded 80,000 tons for the first time.

The improved figures were obtained despite the demands and inevitable dislocations of constant development work. In the open-hearth department, for example, conversion of the six furnaces to oil-firing has proceeded steadily. Work on the installation of a new high-speed electrolytic cleaning line has been completed. A third continuous pickling line has been under construction. Steady progress was also made during 1956 with the erection and equipment of the buildings for the continuous galvanizing line.

ECSC Coal and Steel

Coal and steel output in the countries of the European Coal and Steel Community reached new all-time record levels in 1956. The percentage changes between 1955 and 1956 are topped by Italy, which increased steel output by 9.4 per cent. and pig-iron and ferro-alloys by 15.4 per cent. None of the seven countries produced less than 6.3 per cent. more steel and only the Netherlands recorded a slight falling off in pig-iron and ferro-alloys production (0.7 per cent.).

Provisional figures released by the statistics division of the High Authority show total steel production for 1956 at 56,720,000 metric tons, an increase of almost 8 per cent. over the 1955 total of 52,588,000 tons. The increased output of pig-iron and ferro-alloys was not quite so great (6.2 per cent.), but it was also a record at 43,569,000 tons compared with the total for 1955 of 41,015,000 tons.

A breakdown of the 1956 steel total by member countries (the 1955 production is given in parentheses) is as follows:—Germany, 23,187,000 (21,336,000) metric tons; Belgium, 6,364,000 (5,894,000) tons; France, 13,390,000 (12,592,000) tons; Saar, 3,375,000 (3,166,000) tons; Italy, 5,900,000 (5,395,000) tons; Luxembourg, 3,455,000 (3,226,000) tons; Netherlands, 1,049,000 (979,000) tons. Pig-iron and ferro-alloys:—Germany, 17,576,000 (16,482,000) metric tons; Belgium, 5,662,000 (5,320,000) tons; France, 11,436,000 (10,941,000) tons; Saar, 3,020,000 (2,879,000) tons; Italy, 1,936,000 (1,677,000) tons; Luxembourg, 3,276,000 (3,048,000) tons; Netherlands, 663,000 (668,000) tons.

The community coal, at 248,992,000 metric tons, was 1.1 per cent. better in 1956 than in 1955.

H

Corrosion Problems of Aluminium Alloys

An interesting article written by Mr. J. C. Kingcome, B.SC., A.R.I.C., in the December issue of *Corrosion Prevention and Control*, contains details of corrosion cases, and gives a number of useful hints as to their retardation, or prevention. It has been found by the author, that when an aluminium alloy and a dissimilar metal are in contact, and are subjected to the corrosive conditions of a marine atmosphere, or immersion, a cure can be effected by separating the components with neoprene, an impervious material of the rubber type.

Serious corrosion occurred to a 12 per cent. silicon-type aluminium alloy motor-boat propeller after three months' service. The condition is shown in Figs. 1 and 2. The corrosion was caused primarily by contact with a stainless steel shaft, and cavitation had occurred near the blade tips, this, it is thought, was accentuated by galvanic action. The only practical way to eliminate the galvanic couple that is set up in sea water, was to cover the shaft with neoprene, and recent trials have shown this to be promising.

FIG. 1.—*Aluminium-alloy propeller after three months immersion in sea water, showing the serious nature of the corrosion damage.*

FIG. 2.—*The tip of one of the blades showing details of the cavitational corrosion effects.*

Hadfields' Activities

In a review of the Hadfields group of companies recently published, it is stated that the company has been actively engaged making special parts for nuclear energy plants, and important contracts for control rods have been carried out for the Calder Hall Reactors, and for Chapelcross now in course of construction. Hadfields' boron steels have been specially developed for this purpose. Since the acquisition of the Millspaugh group of companies, many innovations and reorganization schemes have been carried out, and Millspaugh has added considerably to its research and development resources, the benefit of which pass automatically to the pulp and paper-making industry.

The international character of Millspaugh, Limited, is well illustrated by the large number of paper-machinery contracts which the company has on hand, and which range from preparatory plant and equipment for mills in China and South America to suction couch rolls and press parts for mills in Central Europe and Scandinavia as well as a number of important modernization schemes for mills throughout Great Britain.

A good example of this development is to be seen in the company's recently opened laboratory which is one of the best equipped and up-to-date in the trade, also the new foundry for centrifugal castings in stainless steels and non-ferrous metals, as well as the greatly enlarged workshop for steel fabrication.

A noteworthy achievement of the company during the year just ended was the completion and starting up of the new Millspaugh machine at the Thorold Mill of the Provincial Paper Limited of Canada. Within a short time of having started up, this machine was producing speciality litho papers at 600 feet per minute, and plans are already in hand for increasing the speed for which it was originally designed, by another 25 per cent.

Made throughout by companies within the Millspaugh group, its production created something of a record by taking less than 18 months from the first blueprint to the final erection. The actual building time was not more than seven months, and though the schedule was an exacting one, delivery was made dead on time.

In addition to handling practically every type of preparatory and manufacturing plant for the pulp and paper industry the company is producing a great diversity of work for other industries, and is now able to produce centrifugally-cast cylinders as large as any in the world. Every department has been enlarged and modernized in recent months. In view of the great extent to which steel fabrication is being used in paper machinery, special emphasis has been given to the steel fabrication shop which now offers a tremendous capacity for a wide variety of production.

Safety Suit Sales Stunt

"An engineer calmly stepped into a furnace at 700 deg. C. carrying in his arms a bundle of kindling wood, which within seconds was reduced to ashes. A piece of raw steak was cooked to a turn within a minute."

The engineer was demonstrating a type of aluminium coated fire-proof suit lined with layers of fibre glass. They are being employed for kiln and oven repairs and in foundries where there is danger from splashing metal. Similar suits, permitting freedom of movement coupled with high resistance to heat, were displayed at the Factory Equipment Exhibition in 1955, and mentioned in the JOURNAL, April 7, 1955, page 384.

Basic Principles Applicable to Steelmaking in Foundry Practice*

Discussion of Paper by Dr. R. J. Sarjant, O.B.E., and T. A. Cosh

The problem of hydrogen absorption, the developments of oxygen injection and use of oxygen for breaking down the charges are discussed. The remarks also cover the problems connected with oxidation, desulphurization, and the low-temperature properties of steel castings. It is stated that with the advancement in chemical engineering, steel castings having considerable impact resistance at low temperature will become increasingly important. Special melting procedures are discussed in this connection and the Authors recommend the use of ferro-manganese rather than ferro-silicon for deoxidizing. Finally, the importance of applying physical chemistry to steelmaking as a means of producing better steel is stressed.

DR. SARJANT, introducing the Paper, said this was the first of what he hoped would be a series of papers on this subject from the British Steel Castings Research Association. It had been realized that the basic principles of steelmaking, which were very well practised as an art, had had much fundamental science put into them during the last generation. In the steelfounding industry there was a situation in which relatively small-size melting plants were in use, and the job of management was usually rather hectic. The work had to be done against the pressure of demands for output, and the plant manager had not the time or the opportunity or, perhaps even, the inclination to go into the fundamental science of the process.

Over the years, Dr. Sarjant said, he must have read much of the classic literature relating to this subject, and at the end of the war he had had the pleasure of meeting Schenck, and discussing with him his well-known book, "The Physical Chemistry of Steelmaking." One appreciated that it was a pretty tough study for a busy practical man to digest. It had also been Dr. Sarjant's good fortune to know for many years Robertson, who was the steel manager at Shelton just before the last war, and who afterwards worked at John Summers'. Of all the men Dr. Sarjant had met in his life, he considered that Robertson was the one man who had best mastered Schenck's work and who had from the practical point of view actually applied that work in the melting shop.

There was also the work of Chipman, Herty, and numerous other workers who had studied the physical chemistry of steelmaking. The United Kingdom also had its own schools of study; there was Professor Hay's school in Glasgow, where quite good work had been done—the small-scale experimental work which could be carried out in the laboratory. But the melting shop itself was the finest laboratory possible. There, was the furnace itself and opportunities to apply the fundamental science of the process in the way it should be applied. He had always felt that that branch of the art of steelmaking had been neglected more than any other, and he was happy to know that the British Steel Castings Research Association was now undertaking work in connection with it.

Disseminating Basic Knowledge

The first problem was to attempt to crystallize the knowledge that had been acquired in the various workshops and laboratories of the world. Much had been done, but the results had been neglected by the workshop managers for the very good reason that they had been so inaccessible. The papers available had been written mostly by scientists; but scientists had not the art of putting over the information in the way the man in the workshop could understand it, and some day someone had to get down to the task of interpretation. That was one of the problems which Mr. Cosh and himself had set themselves to tackle, and in introducing the Paper he would only try to say what the objectives were; he would not try to pick out the "high spots" in a paper of 14 pages, which could have been 1,400 pages to do the subject justice.

In saying that the fundamental work that had been done was not applied as thoroughly as it should be, he was challenging the steel melting technologists in the industry. They were only too keen to get to know what were the points that were really worth knowing, and the Authors were undertaking a problem which would not be solved at that meeting. Thus, in submitting the preliminary paper, they were opening up a field which they considered could be of very real service to the steelfounding industry.

Dr. Sarjant then concluded by emphasizing one or two of the main points in the Paper.

DISCUSSION

THE CHAIRMAN (Mr. J. Blakiston) said that recently he was looking through some operating records for 1919, which gave the yearly output of an electric furnace of 1,500 kva. capacity as 2,000 tons; he believed that from a furnace of similar capacity to-day it was generally expected that one could get approximately 10,000 tons. Certain steelmakers had said that steel made in less than eight hours was "fit for neither man nor beast," but most of the steel melting furnaces brought down a ton of steel in 70 min., and he asked for Mr. Cosh's broad opinion on that aspect.

* Paper presented at the Cardiff conference of the Institute of British Foundrymen and published in the JOURNAL, September 6, 1956

Hydrogen Absorption

MR. COSH said that, contrary to the Chairman's statement, there was no getting away from the fact that the faster one could melt the steel, the better the quality would be. One of the great bugbears in making steel for castings was the problem of hydrogen absorption. It was largely a question of time; as the time of holding in the molten state increased, the hydrogen content increased, and likewise, as the temperature increased, the quantity of gas increased. If the melting time and the reducing time could be cut down, one would produce steel which was as near as possible of the same gas content as the material that was charged.

Formerly, in this country, there had been a tendency—which in recent years had been changed—rather to under-power furnaces from the electrical point of view. Most steelfounders operated furnaces ranging from 3 to 10 tons capacity, and his own opinion was that such a furnace should be rated at not less than 600 kva. per ton, decreasing slightly as capacity increased. That decrease was not from the point of view of quality requirements, but there was a question of design, and also the fact that one might have to use electrodes which were rather cumbersome.

Oxygen Injection

THE CHAIRMAN then asked for the opinion of Mr. Cosh on the latest developments not only in oxygen injection into the steel bath, but in the use of oxygen for melting down the charge.

MR. COSH replied that that subject had not yet been fully investigated. The essence of good steelmaking was controlled oxidation followed by controlled de-oxidation. Every element present had its own particular affinity for oxygen; there were present silicon, manganese, phosphorus and carbon, oxidizing preferentially, in that order. Thus, when one injected at a low temperature, one tended to oxidize these elements in that sequence. At a higher temperature, free-energy entered into the considerations, and the carbon-oxidation reaction superseded that of the other elements, since the free-energy change involved was less.

If oxygen were injected at the melting-down period, it was excellent, provided the rate of injection was not too high—something like 10 cub. ft. per ton per min.—so that a thorough oxidizing was effected and that one could be sure of removing the maximum amount of phosphorus from the melt, phosphorus being another of the bugbears of steelmaking. The best method was to inject oxygen early in the melt, almost before complete melt down. Phosphorus could be removed by the use of iron oxide in the form of scale. He did not suggest that iron ore should be used for that purpose, but iron oxide would effect adequate phosphorus removal. However, in connection with oxygen injection, there were a great many features which had yet to be determined. Referring to Fig. 9 in the Paper (showing specific oxygen-input required to initiate carbon removal at various initial-carbon levels), he said one would like to have a nice curved line on the graph, but instead of that, there was a very broad and scattered band of spots. In actual practice, from furnaces surveyed to date, the rate of oxygen injection required to remove one point of carbon per ton of steel varied from 2½ cub. ft. to, in one particular case, nearly 100 cub. ft. per min. That was not always the fault of the steelmaker or the melter; in some cases it was the design of the furnace which was at fault. He had tried to give some recommendations regarding bath depth and other factors which were very important and were among the principal causes of the wide band of results shown in Fig. 9. Oxygen injection shortened the overall duration of the melt, it acted as a gas flushing medium and helped to flush out the non-metallics from the bath.

Efficiency of Injection

DR. SARJANT said it was possible from the data on the carbon/iron oxide reaction to calculate from prescribed conditions what would be the rate of the carbon removal for a particular use of oxygen. What was not yet known was the efficiency with which the oxygen was used for specific conditions, and that was the sort of thing that Mr. Cosh was working on. He was carrying out a number of surveys of different types of furnaces in which oxygen injection was being practiced; he was getting the composition of the slag and the metal and was measuring everything he could measure, the slag bulk, and so on (slag bulk measurement was particularly difficult), and ultimately he would be able to say that if one knew what the conditions were, the quantity of oxygen necessary could be calculated and, more particularly, the optimum temperature at which it should be put in. Skill in measuring temperature was important; if the temperature was known accurately—and it could be measured accurately nowadays—one should be able to say how much oxygen to put in. Another field that Mr. Cosh was exploring was whether 97 per cent. oxygen or an oxygen which was diluted should be used. There were many interesting problems, and it was a field of steelmaking which was of great interest to the foundry to-day.

MR. E. DAYBELL asked Dr. Sarjant if it were not the fact that research work dealing with gas or hydrogen content of steel, must be kept within bounds and closely allied to shop-floor methods. If this were not done, the position could arise where, say, extra shrinkage in the metal, due perhaps to freedom from gas, could bring other troubles and the ultimate result would not be a better casting. In other words, the steel melter, with his technical zeal, might provide a wonderful steel, but when the foundryman used it in accordance with normal practice, his casting might prove inferior to one produced from steel which was technically not so good. Such matters must be kept in balance, and that was why the practical approach of the Steel Castings Research Association was so valuable.

Gas-content of Steels

DR. SARJANT said that he had spent twenty years in trying to chase the bogey of the " hairline crack."

In the days before the supersonic crack detector had been produced, investigators tested their knowledge by making an experiment, having already forecast the answer. If the answer obtained was the expected one they would say that obviously they knew something about it; if something else happened they would say "There you are, we thought we knew, but we didn't."

The hydrogen content of the steel, of course, was extremely important in steel forging; it was the one thing which made the steelmaker, operating the electric furnace, wonder what were the possibilities of vacuum melting for taking out the gas. The particular study of steelmaking by the British Steel Castings Research Association was tied up with parallel and cognate research into the microporosity of steel castings; he could give an assurance to members—and Dr. Sully would support him, because he was handling the matter—that this research would be vigorously prosecuted. They were certain that anything done on the steelmaking side would be directed towards ensuring that what the founders poured into their castings would be better steel than used previously—that was their guiding principle.

If founders read about Schenck's researches, it would take months and months to get anything out of what was written. In the appendix to the Paper under discussion the Authors had tried to record some of the more elementary material in such a way that ultimately the young technical man in the melting shop and on the foundry floor should be able to take a set of results from the analysis of slags, the temperatures, etc., and calculate some of the equilibrium constants and, even if he could not apply some of the velocities of the reaction; he should be able to use the free energy, heat of reaction, or whatever one liked to call it. If he really understood that mysterious technique and could handle it, he would find it a very powerful technique, something that was well worth knowing. Dr. Sarjant knew very well that this research had not reached the melting-shop stage yet, but it was hoped to get it there.

Basic Principles

MR. R. S. RICHARDSON said that in his organization they had started making steel in 1922, when there was not much knowledge of the subject, and he and his colleagues had had quite a struggle, making good steel one day and bad steel the next, and by a process of elimination they had gradually reduced their malpractices. He agreed with the Authors of the Paper that, until the basic principles of the chemical reactions were assimilated, the position would never be reached at which it could be said that if they did certain things they would go wrong. Having got down to basic principles, the next thing to do was to get people to agree with them.

From the practical side, he felt that the Authors had minimized the effect of the calcium carbide in its direct relationship with sulphur. They had said that it speeded up the oxidization reaction with sulphur. On the furnace plant it might be said that the reduction of sulphur took place not exactly instantaneously, but in a few seconds, provided there was present the fully reducing calcium-carbide slag. He felt there must be a direct relationship rather than the indirect one the Authors had suggested of the carbide being only a catalytic means of improving the reaction.

Sulphur Reduction

DR. SARJANT agreed; he had always believed that calcium carbide had a direct specific action. The method used for desulphurization was to raise the temperature, get the carbide formed and produce the carbide reaction, then open up the furnace doors and oxidize—in effect remove the sulphur from the slag by burning it out—then repeat the dose and reduce again. That was a perfectly good technique, and with patience, one could get extremely low sulphur-contents. It would appear therefore that if time could be allowed in the refining operation to get the carbide acting to effect the sulphur reduction, and then give just enough time for oxidation of the sulphur in the slag, the sulphur content could be reduced to a very low figure.

MR. COSH added that probably more had been written about sulphur removal than about any other reaction. It was very difficult to determine the exact constitution of a slag at high temperature, but it was important to know it. If thermodynamic data were applied to the five or six equations mentioned it was found that the reactions could not proceed. The main reaction was:

$$CaO + FeS \rightarrow CaS + FeO$$

The sulphur-removal reaction, with lime, produced iron oxide, which in turn had to be removed, and the calcium carbide did that, *viz*:

$$3FeO + CaC_2 \rightarrow CaO + 3Fe + 2CO$$

The removal of sulphur from the slag by oxidation by opening the furnace doors as mentioned by Dr. Sarjant followed on the first of these reactions.

Low-temperature Properties

DR. A. H. SULLY (director, British Steel Castings Research Association), discussing low-temperature properties of steel castings, said that an increasing section of the industry was concerned with making steel castings which must withstand a certain amount of impact stress at low temperatures. With advancements in chemical engineering, that would be increasingly important in the years to come. It was known that steel castings could have admirable impact-strength at room temperature, but could be extremely fragile and brittle at -50 deg. C. That phenomena was not entirely related to the elements determined in normal routine analysis. He invited the Authors to speculate on what changes in steelmaking procedure might be involved in producing high-quality castings for use at low temperatures.

MR. COSH agreed that low temperature impact resistance was becoming more and more important in steel castings and special consideration was being given to the making of castings which had to survive a certain Izod-impact type of test at -50 and -75 deg. C. Castings for use at low temperature. for preference, should not be made by any

other means than the double-slag basic electric-arc process. Secondly, care must be taken to ensure that the material used was free from extraneous metallic constituents such as tin, copper and the like. One must ensure a good and fairly high as-melted carbon content, and a minimum removal of 20 points of carbon—this should be shifted as quickly as possible by the oxygen-injection technique.

At the deoxidation stage, he recommended the use of ferro-manganese rather than ferro-silicon. One needed to keep the reducing period as short as possible. As a final deoxidant, although aluminium was almost universally used in the steel castings industry, it was not the best. Deoxidation presented a difficult problem. It was not just a question of getting a material which had the highest affinity for oxygen; there were other factors, for instance, the products of the deoxidation had to be considered. Aluminium as a deoxidant produced alumina and hercynite, both of which were of fairly high melting point. The ideal was to produce deoxidation products which were not only fluid, but which had comparatively low viscosity at steelmaking temperature, and for preference, he would use calcium-silico-manganese, which would tend to form large particles at the particular temperature, so that they would float up into the slag as rapidly as possible. For that reason, he suggested using the manganese complex although it was more expensive than silicon or aluminium.

Other Points

DR. SARJANT agreed with Mr. Cosh. In the old days, steel makers used to talk about "body." What was "body" in steel? He believed it could be defined by the very simple term "purity" and really represented the result of good deoxidation practice, as Mr. Cosh had explained.

A point which was extremely important had been raised by Dr. Sully, namely, that if by the application of the physical chemistry of steelmaking a better steel could be produced, then steels could be made having better properties at lower temperature. Whilst he believed that the deoxidation process was important, as was also the degassing of steel, Dr. Sarjant confessed quite frankly that if it was not purity he did not know yet what "body" was, and he was not sure that anybody else knew. It was one of those intangible properties which nobody had been able to describe by any other term. Some day, someone might be able to find out what it was, and then he could answer Dr. Sully's question.

MR. R. A. STILES asked whether the reference by Mr. Cosh to arc-furnace melting meant that steels having high Charpy-impact resistance could not be made satisfactorily in high-frequency induction furnaces or, from a mains-frequency induction furnace.

MR. COSH replied that one could melt steel in a high-frequency furnace. He had been thinking of steelmaking in terms of the arc process *versus* the open-hearth process, and the basic-arc furnace process in particular in which inclusions could be reduced to a very low figure.

THE CHAIRMAN thanked Dr. Sarjant and Mr. Cosh for their very admirable treatise, and said he was pleased it would precede several others of like nature. He added that no doubt there were many who, when they had had time to study the Paper fully, would wish to enter into correspondence with regard to it,

Midlands Industry Report

The Midlands Regional Board for industry, after consideration of a report by the Regional Controller of the Ministry of Power and the Regional Transport Commission, stated, on January 15, that having regard to all the difficulties it was satisfied that petrol and oil rationing was being conducted in "a very satisfactory and efficient manner," although disappointment was expressed at the failure of traders to transfer their goods from road to rail. It was also learnt from the report that no factory in the Midlands has had to shut down and no unemployment has been caused by shortage of fuel for process work and industrial heating. The general employment position was worsening, however, largely owing to the effects of fuel rationing on the motor industry. Short-time working affected 35,000 of whom 22,000 were employed in the motor-car industry and nearly 3,500 in the manufacture of motor-cycles and cycles.

Old Engravings

J. H. Villard Incorporated, dealers in rare prints and books, of 175, Fifth Avenue, New York 10, N.Y., have assembled an important collection of old engravings, mostly of the 18th century, featuring scenes of the metal industries, such as smelting, refining, rolling, fabricating, etc. The collection can be seen preferably by appointment. Some of the pictures are for sale or can be hired for publicity purposes. Correspondence from collectors who have duplicates to exchange is invited.

Quick Delivery !

Lec Refrigeration, Limited, of Bognor Regis, Sussex (whose premises include a sizeable grey-iron foundry), lose no time when they need something quickly. They maintain their own air-freighting service which serves them well in times of urgency. This was illustrated when Quasi-Arc, Limited, Bilston, Staffordshire, received a telephone call from them one morning recently, saying that some powder for their Unionmelt welding installation was required urgently. Within a few minutes of the call, the firm's twin-engined Gemini aircraft was airborne for Elmdon Airport, Birmingham, where the Quasi-Arc van met it with a load of the powder. This was immediately loaded into the aircraft which took off again within minutes, arriving back at Bognor Regis shortly after 1 p.m.

Bulk Air-drying

An important order has been received by Birlec, Limited, from the Ministry of Works for the National Gas Turbine Establishment, Pyestock. To be engaged in drying compressed air at the rate of 200 lb. per second, the drying plant will form part of an "altitude cell" for testing jet engines at ground level, while simulating the varying conditions between ground and high altitude. The dryer, an entirely special model, will be the largest ever installed by the firm. It will consist of two beds of desiccant each containing 10 tons—though with a capacity of 15 tons—in two horizontal cylinders 10-ft. dia. and 25-ft. long.

Equipment & Supplies

Ultrasonic Soldering Equipment

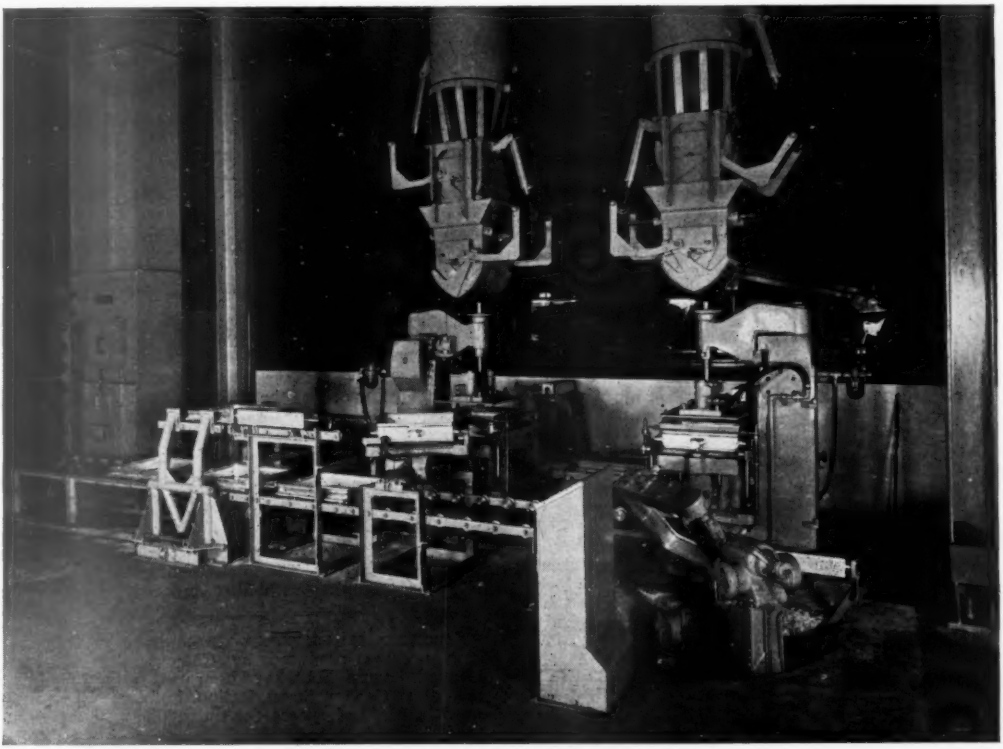
To overcome the difficulties associated with the soft soldering of materials, such as aluminium, possessing a refractory oxide film that cannot be removed by normal fluxes, Mullard, Limited of Torrington Place, London, W.C.1. have developed ultrasonic soldering equipment which enables satisfactory joints to be made on these metals with, it is claimed, the ease of a normal soft-soldering operation. The equipment is available either in the form of an iron for normal joints, or as a bath for the rapid dip-tinning of aluminium wires and small articles. The soldering iron, of the pistol pattern, has either a chisel shaped or tapered copper bit, which is heated by means of a low-resistance winding, the power being supplied directly from the power unit. To impart the ultrasonic vibration to the bit a magneto-striction transducer is used, this is controlled by a trigger switch in the handle.

The transducer consists of a U-section stack of cobalt-iron alloy laminations, one limb of which carries the drive coil. The transducer is a half wave-length resonant section—having a natural resonant frequency of approximately 20 kc/s when cold, falling to about 19 kc/s when hot. It is supported at its nodal point by a clamp. Silastic blocks are inserted between the faces of the transducer and the clamp in order to provide some resilience, which prevents undue damping of the vibratory movement. For foundry applications the use of the soldering iron is recommended for the manufacture and fabrication of aluminium patterns, the treatment of surface blemishes on a casting, and filling in porosity holes on a casting. The cost of the combined soldering iron and generator is given as less than £100.

Automatic Moulding Unit

A fully automatic moulding unit which was shown by Alfelder Maschinen Fabrik Kuenkel, Wagner & Company, at the International Foundry Congress, Düsseldorf, is illustrated in Fig. 1. It consists of a number of units, the arrangement of which can be varied according to the particular requirements of a foundry. The inside measurements of the boxes used in this case are 18 by 22 by 4¾ in., but these can be varied within certain limits, so introducing a measure of versatility. The moulding boxes can be easily moved on run-in and run-out rails which are equipped with guide rolls. The transport of the boxes is effected by air-operated pistons which are placed in appropriate positions. In the main the installation consists of the following units:—Two standard fully automatic pin-lift moulding machines, and two lifting and turning tables; a lifting, turning and rollover table; a plain turn-table; box assembly; and run-in and run-out rails.

FIG. 1.—*General view of a typical automatic mould producing unit (by Kuenkel, Wagner & Company) incorporating two pin-lift machines; lifting, turning and rollover tables; box-assembly and rail systems.*



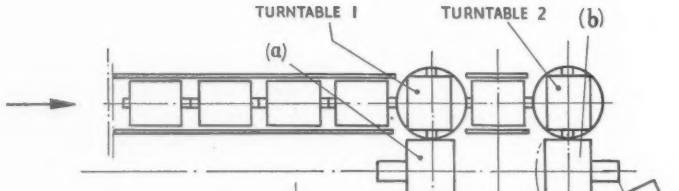


FIG. 2.—*Plan view of an automatic moulding unit.*

KEY: (*a*) Moulding machine for the cope and (*b*) for the drag; (*c*) box-assembly device; (*d*) turntable; (*e*) control panel; (*f*) core laying point, and (*g*) lift-, turn- and roll-over table.

Operational Sequence

In the arrangement shown in Fig. 2, the following is the working sequence:—The lift and turntables (1) and (2) are ready to take up the empty boxes, which travel on the run-in rail. As soon as both tables have received boxes, they turn by 90 deg. and lift to the required level from which the box is passed on to the moulding machine. On the machine, the boxes are filled with sand by an automatic measuring device. When the moulds are completed, the finished top-part is removed to a turntable and then passed on to the top section of the conveyor. On the turn and rollover table the bottom part of the mould passes on to the automatic lifting device and is turned over. From there it passes to the lower conveyor rolls where, in a convenient place, cores can be inserted, as necessary. The moulds are then passed by guide rolls to the box assembly, where the bottom box is lifted to the top box and at the same time pins are pushed through guide bushes which ensure a proper registration. Finally, at the end of the top conveyor, the finished moulds are lowered on to the run-out rails.

During this operation, turntables (1) and (2) have reverted to their original position, ready for loading further empty boxes, and prepared for the new sequence of operations. The operation of this moulding unit is pneumatically controlled; when making simple moulds, with few cores, one operator only is necessary to control the unit from a separate control panel. If moulds with complicated cores are to be made, the installation can be arranged by increasing the length of the conveyor to allow a longer time for coring. The run-out rails can be connected with the pouring station. The boxes with the finished castings travel to a shake-out and the empty boxes return to the run-in rails.

The British agents for this machinery are Ernest Fairbairn, Limited, Manfield House, 376-9, Strand, London, W.C.2.

Porosity Paste

Water Paste Suppliers, 35, Tanner's Hill, London, S.E.8, have produced a porosity paste, No. 156, which is intended to be used as an additional aid for revealing porosity in metal rather than to supersede methods of pressure testing by air and water, normally used in the industry. It is particularly useful in those cases where porosity is present but cannot be discerned with the naked eye, or in cases where it is necessary to test for porosity under indifferent lighting conditions. The paste which instantly changes from green to red upon water coming into contact with it, determines the presence of water in almost every given condition, and is claimed to be ideally suited for checking leaking castings. To check the efficacy of this material, a sample of the paste was sent to a leading foundry, where it was reported to respond quite satisfactorily when used in the manner directed.

Non-inflammable Hydraulic Fluid

The Fina Petroleum Products, Limited, of Victoria Street, London, S.W.1, are now producing a new hydraulic fluid, which has been developed for use in hydraulically-operated die-casting machines. For many years these machines have been a potential source of danger from fire, especially if normal mineral hydraulic fluids were employed. The new product, Fina HT.38 hydraulic fluid, is claimed to be non-inflammable, whilst behaving like an oil in all other respects. The fluid has a solvent action on certain seals, which are sometimes used in die-casting machines, however, seals made from "Butyl" synthetic rubber are quite safe, and will not disintegrate. Those made from natural rubber and "Neoprene" may also be used, although their respective lives are shorter than "Butyl."

Speed Reducers

The success of the shaft-mounted speed reducer introduced two years ago has been so marked that J. H. Fenner & Company Limited, of Marfleet, Hull, are now extending its scope by introducing a range of six single reduction torque-arm units. These have a fixed speed of 5:1 ratio, and as a result they are suitable for use with 1,440 r.p.m. motors, to give (in conjunction with the V-belt drive) final output speeds in the 90 to 375 r.p.m. range. It is claimed that these new single reduction torque-arm speed reducers provide the same big advantages in this range as the companion, double reduction units, have brought to the field of lower speeds. They are practical and economical, easier to instal and much more flexible in application than the conventional floor-mounted reduction box.

Welding Helmet

A new welding helmet is in production at the safety goggles division of J. & R. Fleming, Limited, 146, Clerkenwell Road, London, E.C.1 Conforming to B.S. 1542, the helmet is of one piece construction with deeply curved sides for protection against sideflash and reflected radiations. The total weight of the new helmet is 23 oz., complete with filter and cover glass.

MODIFIED SEMI-SLEWING VERSIONS of the Staffa 3 mobile crane produced by Chamberlain Industries, Limited, Leyton, E.10, have been used in the rebuilding scheme at Cannon Street Station, London. They were used in confined spaces for unloading materials from trucks.

Notes on Condensation in Industrial Buildings

*By L. Gordon Davies**

Before considering the problem of condensation, certain fundamentals must be clearly understood. For clarity these are tabulated as follow:—

(1) *Dew-point temperature.* The dew-point temperature is that to which air can be cooled before condensation occurs; the air becomes 100 per cent. saturated, *i.e.* incapable of absorbing any further moisture. If cooled below the dew-point temperature, some moisture will be liquified and appear as condensation upon surfaces or as mist in the air.

(2) *What determines the dew-point temperature?* The amount of moisture solely present in the air.

(3) *What limits the amount of moisture the air can absorb?* This is governed solely by the air temperature. When the air can absorb no more moisture, it is said to be 100 per cent. saturated. The higher the air temperature, the greater will be its ability to absorb moisture.

(4) *Relative Humidity.* This is the ratio of the weight of moisture present in the air to the total weight of moisture that the air could absorb at the given temperature multiplied by 100. At the dew-point temperature, the air is at 100 per cent. relative humidity.

(5) *Absolute Moisture Content.* In analysing condensation problems, it is usually more convenient to consider the actual weight in grains of moisture which are present with each pound of (dry) air. This is known as the absolute moisture content. The grain is a convenient unit of weight in this context, there being 7,000 grains to each pound.

Condensation is the deposit of excess moisture from the atmosphere. Its occurrence in the foundry industry is very common particularly in the foundry itself and all places where heating has been provided by flueless gas appliances. Considerable moisture gains result from the combustion of gas (300 grains per cub. ft. of town's gas). All are familiar, of course, with the sight of steam rising from the moulds during the pouring of green-sand and skin-dried moulds. In the pattern stores particularly, condensation can cause deterioration of both wooden and metal patterns. Normally condensation occurs on the underside of the roof, steelwork, tools or equipment and wherever the surface temperature is lower than the dew-point temperature of the surrounding air. The biggest single instance of condensation is dew itself caused by the fact that at night the earth's surface is lower than the dew-point of the atmosphere. Possibly the most acute condensation problem not uncommon to certain, industries is the formation of mist or "fog" in the shop, this being caused by cold entering air reducing the temperature of the moisture laden air within the building below its dew-point.

* The Author is technical director, Colt Ventilation, Limited

Effects

Usually, condensation results in corrosion or rotting of the metal or material on which it forms. The irreparable damage caused in this way over a comparatively short space of time, and the constant renovation and re-decoration that becomes necessary, costs far more than would the measures to prevent condensation. The difficulty is to identify the most economical means to prevent the condensation and this can only be ascertained by a complete analysis of the problem obtained by actual measurement in the case of an existing problem, or by calculation, where provision must be made to prevent condensation in a new building.

In either case the following information must be determined:—(*a*) The extent of moisture gains within the building; (*b*) in the case of existing buildings, wet and dry bulb temperature gradients. It is important that these should be recorded at various positions throughout the shop and in any other departments which are intercommunicating; (*c*) rate of ventilation existing or proposed in the case of a new building; (*d*) heat gains from plant and the heating system; (*e*) insulation value of the structure; (*f*) nature of moisture production. Is it continuous or intermittent? and (*g*) to what extent the condensation must be prevented. Generally it is quite permissible for condensation to occur on the underside of roof glazing, while quite often this has the lowest surface temperature in the structure. By recognizing this, therefore, the extent of preventative measures can often be considerably reduced with proportionate savings in expenditure.

Obtaining Information

In the case of an existing condensation problem, the only practical way in which the necessary data can be obtained is by carrying out a complete survey of the building, for which certain instruments are essential; sometimes it is unnecessary to use all these instruments but they may well need to be available. These are:—

A sling psychrometer, or any other type of instrument to measure the wet- and dry-bulb readings. In some cases, wet- and dry-bulb recording instruments are necessary, which operate over a period of a week, and several of these instruments may be necessary to keep a true picture of the conditions inside and outside the works.

Air velocity measuring instruments, such as a velometer or vane or cup anemometer are necessary to measure the amount of air entering and escaping from the building, from which information the existing air change-rate can be calculated. Smoke candles or titanium-tetrachloride tubes are sometimes used to measure slowly moving air and when correctly applied, quite accurate results are obtainable.

Maximum/minimum thermometers are most useful for ascertaining the high and low dry-bulb

Notes on Condensation in Industrial Buildings

temperatures over a period; for surface temperatures, a surface thermometer or Thermochrom pencils can be used. Radiant heat is measured by a radiant-heat comparator which, unlike other instruments, locates the source of the radiant heat. For obtaining the average local radiant heat, the standard globe thermometer is used.

Having taken measurements with the equipment referred to, one can then proceed further with the analysis and treatment of the problem. By using the wet- and dry-bulb temperatures in conjunction with hygrometric tables, and by comparing this with similar readings taken outside the building, the moisture gain in grains per lb. of dry air can be arrived at. Given the ventilation rate of the building, one can calculate the total moisture gains within the shop.

One must then consider the surfaces on which the condensation forms, or on which it is liable to form. Where these are part of the building structure, the "U" value must be determined. From this, one uses a conversion formula involving "U" value and the inside and outside temperatures, to determine the surface temperature. By these means the surface temperature can be determined under extreme mid-winter conditions, even during the summer-time. As will be appreciated, the lowest surface temperature is the maximum permissible dew-point temperature of the air in the building, and this is dictated solely by the moisture content of the air. It becomes therefore necessary to reduce the moisture content to limit the dew-point. Generally, in industrial buildings where there is excess heat owing to heat gains from processes, this can be achieved by means of ventilation alone. Sometimes, however, the drop in temperature resulting from the additional ventilation required to remove the excessive moisture, is such that further heating must be provided. In making provision for further heating, it is essential to consider the medium by which additional heating is provided, so as to avoid further moisture gains from combustion.

Obviously, if a condensation problem can be overcome by ventilation alone, this is the most inexpensive means of dealing with this problem, whilst the additional ventilation provided is extremely beneficial during the summer months. In some circumstances it may be advisable to increase the insulation of a particular part of the structure, thus raising the surface temperature above the permissible dew-point. Once more this would be considered against the costs of heating where the temperature drop caused by additional ventilation might be considered excessive.

Removal of Excess Moisture

Apart from the methods of survey and measurement referred to, the best method of achieving the removal of the excess moisture by ventilation is as important as obtaining data by survey. The most advantageous siting of equipment must be determined, and very often this is only possible by tracing thermal currents within the building, thus harnessing them to provide extraction of the excess moisture before it can spread through the building. Similarly, when condensation occurs at certain times of the year, it is essential to consider the effects of the winds prevailing at that time over the building, as this might well affect the ventilation rate measured during other wind conditions; siting of fresh-air intake ventilators is also of primary importance.

Other Considerations

In dealing constantly with the problem of condensation, there are many other considerations that can be made, *e.g.* can screening be arranged to trap excess moisture gains for immediate removal, or alternatively, can hoods be designed to remove the moisture directly above its source, in the case of an open tank? Is condensation occurring because of leaks of moisture laden air through doorways interconnecting between departments? Quite often the fitting of a return spring to a door has prevented condensation occurring in such circumstances. Condensation must also be given to the heating of the building, with particular reference to the time at which the heating equipment begins to function, *e.g.*, if plant in a building has a considerable thermal capacity then, unless sufficient heat was made available to take care of this before the moisture-emitting process commences, condensation would occur on the plant in question, during some part of the heating-up process. The corollary of this is that if the means of heating the building is shut off before the building has been sufficiently ventilated to remove excessive moisture, then once more condensation will occur.

To sum up, therefore, there are definite hard and fast rules for dealing with every condensation problem, but these can only be intelligently applied by an expert in this subject. The prevention of condensation can be effectively catered for in the case of a new building on the drawing board as that of an existing building, whilst similarly provision can be made to prevent condensation occurring before installing moisture-emitting plant in any shop.

Raw Materials Price Index Rises

Further rise in the level of prices of basic raw materials brings the index figure for December to its highest point since May, 1952. The Board of Trade's monthly index of basic material prices rose by 1.1 per cent. to 161.1 per cent. in December, 1956 (June 30, 1949 = 100). The rise over the year was 3.7 per cent., and for 10 months up to last October the index figure had fluctuated between 154 and 155, but the Suez Canal crisis caused a sharp rise in the prices of several materials, particularly oil, rubber, wool, and jute. Crude oil rose by 9.5 per cent. during November.

The indices of prices of materials used in the mechanical engineering and electrical machinery industries rose by 1.3 per cent. and 0.6 per cent. respectively in December, largely owing to higher prices for iron and steel and for brass ingot and rubber.

The biggest increase in prices of manufactured goods over the year was in the section for the products of blast furnaces and iron and steel melting, where the rise was 9.6 per cent.

Morgan Crucible Company's "Spring-clean"

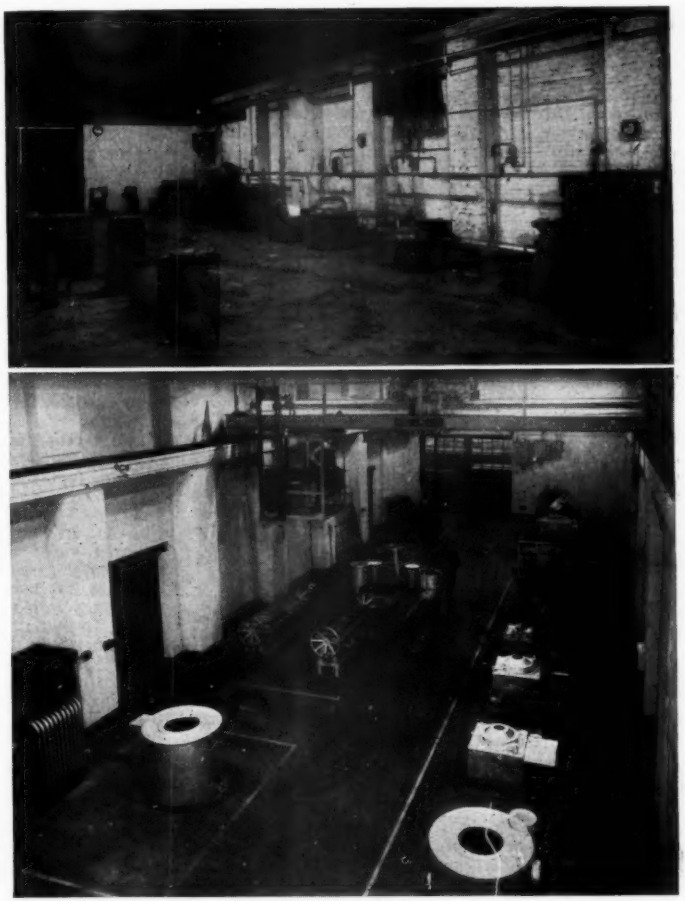
Renovation of the Battersea Test Foundry

Described somewhat modestly as a "spring-clean," the Morgan Crucible Company, Limited, have completely renovated and re-arranged the test foundry attached to their works at Battersea. This was shown to members of the technical Press on January 7. The foundry was previously visited by the writer when premises in that section of the Battersea works were placed at his disposal for the judging of entries in an Apprentice Competition organized by the London branch of the Institute of British Foundrymen and the change that has now been effected is really outstanding (Figs. 1 and 2).

The test foundry has been operating for many years, serving three main functions: (1) To demonstrate the uses and advantages of crucible melting and to show the complete range of Morgan furnaces operating under service conditions; (2) to develop and test the furnaces and (3) to act as a proving ground for new types of crucibles and for samples from production batches. When need for renovation became apparent, rather than attempt the changes piecemeal, it was decided to close the foundry and make a thorough job of it. The following is a list of the main work undertaken: An oil ring-main system has been installed, the main heater in the pump house being duplicated; all services have been ducted into the floor with self-contained service panels arranged at each of nine furnace stations—including main air-blast and compressed-air supply, electricity "points," Chrome/Alumel and Pt/Pt-Rd thermocouple connectors and town's gas supply, centralized high-speed pyrometric equipment—along with portable indicating and recording instruments —; an ingot casting and knock-out area, with Telcon steel flooring has been provided; colour-corrected lighting, using mercury discharge lamps alongside filament lamps, and remote-controlled motorized roof shutters (by Henry Hope & Sons, Limited) are incorporated. Plastering of the walls and the choice of a pleasing colour scheme now gives a cheerful appearance to the shop. A most noticeable change has been the boxing-in of all the structural steelwork, including crane-rail supports, with asbestos board. Though the foundry industry generally would find this procedure difficult to adopt, it does show what can be done to remove the unsightly feature posed by dirty—and usually dusty—steelwork.

Amongst items which were exhibited to the visitors were casts of copper, gun-metal and aluminium and there were demonstrations of nitrogen degassing using "Salamander" tubes. A simple conversion set for changing a furnace from oil- to gas-firing

(Continued overleaf, foot of column one)



FIGS. 1 AND 2.—*Before-and-after pictures of Morgan Crucible Company's test foundry at Battersea, indicating the substantial improvement effected during the renovation.*

Nickel in 1956 and the Future

A statement made by Dr. John F. Thompson, chairman of the Board of International Nickel Company of Canada, Limited, contains the following references to the applications of nickel: The steel industries of the world continued during 1956 to use the largest proportion of the primary nickel available to industry, principally in the production of stainless steels, engineering alloy steels and jet-engine alloys. The output of the nickel-containing engineering alloy steels in 1956 was limited by the availability of nickel and production approximated that of 1955. The high nickel/chromium alloys, such as the Nimonic series developed by the company's affiliates in the United Kingdom, and the Inconel alloys developed in the United States, continued to play an important rôle in the construction of aircraft engines and industrial gas turbines.

Cast Alloys

In the field of non-ferrous castings there were further applications of nickel-containing high-tensile aluminium-bronze for propellers for large passenger and cargo ships as well as pleasure boats. This alloy is being used in increasing quantities in Europe as well as in the United States. The production of Ni-Resist corrosion-resisting nickel cast irons increased during the year. These alloys were broadly used in the chemical process and petroleum industries and in high-powered engine service to resist corrosion, heat and wear. The output of Ni-Hard abrasion-resisting nickel/chromium cast irons also showed an increase over 1955. Leading applications for these alloy irons were grinding balls and mill liners, as used by the cement and mining industries.

International Nickel's capital investment in Manitoba, as currently projected, will approximate $115,000,000, with a view to initiating the production of nickel by 1960. These expenditures include the cost of opening and development of two mines—to be known as Thompson Mine and Moak Mine—of constructing a concentrator, smelter, refinery and transport facilities and of providing certain accommodation. The project in Manitoba, together with the progress under way at the Sudbury district operations will lift the firm's regular annual nickel-producing capacity to 172,000 tons. Based on Inco's programme and the plans of other firms it is expected that total "free" world nickel-producing capacity in 1960 will approximate from 270,000 to 280,000 tons, representing an increase of some 76,000 to 90,000 tons above the total for 1955. It is evident that a huge demand must be provided in order to absorb this projected enlarged nickel-producing capacity.

Morgan Crucible Company's "Spring-clean"

(*Continued from page* 113)

(using the same burner) was certainly topical and the writer was particularly interested to learn that use in foundries of the firm's prefabricated ladle linings (available up to 15-cwt. capacity) is increasing, though mainly among ironfounders and especially Meehanite founders. Between the lining and the ladle bowl, a layer of vented insulating concrete has been found efficacious, this being applied to the bowl as a sloppy mixture before inserting the liner.

NUMAS

The initials NUMAS stand for the name of a new company, the National Union of Manufacturers' Advisory Service, Limited. It has been formed as a result of the success of an industrial advisory service set up some three years ago by the NUM with the help of Counterpart Funds. The office of the new company is at 45/46, St. Paul's Churchyard, London, E.C.1 and is of the nonprofit-making type. Its main field of activity is work-study and rational costing for firms—comprising a great slice of industry—where fewer than 100 workpeople are employed. Both the chairman of the new company, Mr. Gilbert Salter, and the managing director, Mr. G. L. Page, cited a number of cases where much success had resulted from the help given. In these small firms, the owner is the real "boss," and the problem so often arising when a large company employs an efficiency expert—where the departmental managers get quite worried as from whom to expect their orders—does not apply. This mental confusion is liable to neutralize any potential benefits in large firms. An assurance was given to the writer by Mr. Salter that the small manufacturer and his staff regarded the NUM representatives as being of their own type. As was the case of "Conditional Aid," the services are offered to any concern be they members of the NUM or not.

The Association of Bronze and Brass Founders successfully operated a similar scheme but it was restricted to the trades for which they cater. This new scheme is intended to cover a much wider field, but does include manufacturers of cast products. Being a nonprofit-making organization, run by manufacturers for manufacturers, the fees should be kept at a reasonable level. At the Press conference at which the scheme was announced, the various speakers stressed the help that could be given in the direction of work-study.

Search for Natural Gas in Yorkshire

Imperial Chemical Industries Limited, have recently agreed with B.P. Exploration Company Limited, (its exploration subsidiary), to undertake joint exploration for natural gas in the Whitby (Yorkshire) district. In the past few months seismic reflection surveys have been carried out in this area to get more information about the strata lying deep underground. Very many explosive charges have been fired, mostly in shallow boreholes but some in the sea off Robin Hood's Bay, and the sound waves reflected from the underground layers have been recorded by means of delicate instruments such as are used to detect earthquake tremors. The data so obtained have been correlated with what is known from boreholes already sunk in the area to look for natural gas, and a tentative map of underground contours has been drawn.

The conclusions drawn from the survey are held to justify further drilling for natural gas, and as a first step it has been decided to deepen a borehole at Robin Hood's Bay which was originally drilled by Fisons Limited, in 1949/1950 during the search for potash. The limestone formations in which natural gas may be present lie several hundred feet below the potash beds. Planning permission for the deepening of the borehole was granted at the meeting of the Area Planning Committee held on January 10, and it is expected that work will begin during the course of a week or two. These operations are not related to the search for natural gas at present being conducted over a very much larger area by the Gas Council, for whom B.P. Exploration Company are acting as consultants and operators.

Trade Effluents—"Prescriptive Rights" in Jeopardy?

Local Authorities May Get More Control

A suggestion that local authorities should be given greater control over the discharge of trade effluents into the public sewers has been put to the Government by the Association of Municipal Corporations, which represents borough councils throughout the country. The Association is urging in a memorandum that the "prescriptive rights" possessed by many concerns should be abolished and that the whole of the effluent discharged into sewers should be fully controlled by the local authority. It points out that continuance of the existing exemptions will make it difficult, if not impossible, for many local authorities to comply with the standards of purity of sewage effluents likely to be required by river boards under legislation dealing with the prevention of pollution.

A local government correspondent writes: The Association's suggestion, which is well backed by other organizations in the municipal field, coincides with the appointment by the Central Water Advisory Committee of a sub-committee to look into this very question. Under present law many manufacturers of all types who were in business before 1937 have what is known as the "prescriptive right" to discharge their trade effluents—waste water and so on—into the public sewers. Others have to conform to a rigid system of rules and regulations and must pay for the right to use the drainage system in this way. It is this situation, and the difficulties created, that is likely to be the experts' main working point.

Legal Position

The legal history is that, by an Act of 1876, local authorities having sewers under their control were required, subject to certain limitations, to give facilities for manufacturers to discharge liquids from their factories or manufacturing processes into sewers. These provisions were reproduced in substance in the Public Health Act of 1936, but the law was changed when the Public Health (Drainage of Trade Premises) Act of 1937 came into force. The general principle of this Act of 1937 is that, before discharging any trade effluent into a public sewer, the occupier of the premises concerned must give notice to and obtain the consent of the local authority, which may be given subject to conditions. These conditions relate to the times and rates of discharge, the maximum quantity of trade effluent which may be discharged on any one day, and the nature or composition of the effluent. The authorities have powers to require the treatment of the effluent before discharge (this is in order to eliminate any constituent likely to injure or obstruct the sewers or hamper the treatment or disposal of sewage); they may also require payment to be made.

Prescriptive Right

However, there are important exemptions from the requirements of the Act in favour of occupiers of business premises from which trade effluent was discharged into a public sewer during the year ended March 3, 1937. In effect, the occupier of any such premises can let his waste water, chemicals and so forth go without giving any notice or obtaining any consent. This is so long as (*a*) the effluent is of the same nature or composition as that discharged at any time during the specified year, (*b*) the highest rate of discharge during the year is not exceeded and (*c*) the quantity discharged on any one day does not exceed the maximum quantity discharged on any one day during the year.

It is this prescriptive right—and few will doubt its value—that the municipal bodies want abolished. It is this point of view they will argue before the Central Water Advisory Committee's expert panel. One of the principal advocates of a change of law is likely to be London County Council. Its rivers and drainage committee has not been slow in the past to draw attention to the difficulties the prescriptive rights have caused authorities.

Weighty arguments are brought forward, however, by the Institute of Sewage Purification. It has waged its own campaign against prescriptive rights for many years and in 1952 published a report which might well be taken as the "brief" for the municipal standpoint. What the authorities maintain, in effect, is that any differentiation between the rights of one trader and another is bound to operate unfairly.

From the traders' point of view, it is argued that discharges permitted under prescriptive rights might put such a strain on the sewage purification plant that the authority is compelled to place stringent conditions on the discharges of other factories not possessing such rights. Thus, as the Institute points out, many factories may suffer considerable hardship because of privileged discharge of effluent from a few premises in the same district. Development of new manufacturing techniques, increased use of detergents and the introduction of various chemicals make sewage purification and the maintenance of drains more difficult, say the authorities in their case for increased control.

Although this article deals with industry without being specific, it is obviously in the interests of individual founders and enamellers to find out the nature and quantity of industrial effluent arising in their processes. They will then be in a position to speak with foreknowledge if enquiries are made by the local authority.

MARCO CONVEYOR & ENGINEERING COMPANY, LIMITED, announce that they have appointed Andrew McNair & Company, of 261, West George Street, Glasgow, C.2, as their sole agents for Scotland.

KELVIN & HUGHES (INDUSTRIAL), LIMITED, Caxton Street, London, S.W.1, are again exhibiting at the Leipzig International Fair which is being held from March 3 to 14.

Titanium Casting

The Technical Information and Documents Unit of the Department of Scientific and Industrial Research has included in its summaries of reports available:—

Development of Processes for Making Titanium Castings other than Ingots (*No. P.B.* 118325).

Graphite, but not copper or aluminium, proved to be a feasible permanent-mould material for casting simple parts. A number of materials for shell-moulding were tested, in particular electrically fused zirconia which gave minimum pinholing and a smooth finish as illustrated by photographs of a step-shaped test-specimen. A one to three wash of Aquadag and isopropyl alcohol reduced pinholing more than other washes used. Experiments with non-gassing moulds, *e.g.* carbon, were in progress. The depth of surface contamination in shell-moulded castings was investigated. A 4½-lb. hatch-cover plate was cast in Ti/7 per cent. Mn and Ti/1 per cent. Fe/1 per cent. Si alloys. A tilting arc-melting furnace in which the Ti is melted in a Ti "skull" or bath is described, with diagram. Sponge-Ti electrodes may be used for building up the thickness of the bath again after each pouring. (Lang, R. M., Kura, J. G., Jackson, J. H. Battelle Memorial Institute, 1952. 34 p. microf. 8s. 6d., enl. pr. 42s. 6d.)

Development of Processes for Making Titanium Castings other than Ingots (*No. P.B.* 118326).

This report describes further work done on (*a*) permanent-mould materials (*b*) shell-moulding and (*c*) an induction-melting furnace. Pinholing and surface contamination occurred with all permanent-mould materials made from refractory oxides, even with ammonium or magnesium silicofluoride incorporated as a gassing inhibitor, but graphite, pressure-moulded with 1 per cent. phenolformaldehyde as binder, gave promising results, especially when followed by careful pickling in 50 per cent. H_2SO_4 containing ammonium bifluoride. The best shell-moulding material was zirconia bonded with zirconium nitrate. (Lang, R. M., *et al*, Battelle Memorial Institute, 1954. 96 p. microf. 24s., prints, price on app.)

Vibration of Axial-flow Compressor Blades

Blade vibration, with the possibility of a failure, is one of the major factors controlling the reliability of axial-flow compressors. Self-excited vibration occurring at part load, when some blade rows are stalled, often causes most trouble. An investigation into this phenomenon undertaken by A. D. S. CARTER, B.Sc., and D. A. KILPATRICK, B.Sc., is described in a paper presented to the Institution of Mechanical Engineers on December 7. The main objective has been to determine the major factors governing the vibration, and to establish, if possible, some design rules which would reduce the chances of a failure to an acceptable minimum.

In their conclusions, the authors say that there is obviously still much work to be done, but, it is believed that the back of the problem has been broken in that a reasonable understanding of the physical phenomena has now been obtained. It has been found possible to formulate a semi-empirical design rule which, it is hoped, will reduce to an acceptable minimum the chances of a blade failure. The value of the rule should increase as experience in its use is obtained. The authors do not doubt that satisfactory compressors will be developed in the hard school of practical testing which will conflict with the rule, but design rules must represent an average—a good average—from which to start developing.

Lighting of a Modern Foundry

Two hundred GEC twin-lamp 8-ft. fluorescent fittings and 150 single-lamp 8-ft. fittings have been installed in the foundry of Platts (Barton), Limited, Manchester, the arrangement being shown in Fig. 1.

The principal difficulty encountered by the GEC engineers who planned the lighting scheme was caused by the large amount of overhead equipment necessary in the foundry. Experiments were carried out using combined mercury/tungsten units, 400-w colour corrected mercury units, 140-w sodium units, and twin lamp 125-w 8-ft. fluorescent tubes; the latter proving to provide the most effective illumination under the conditions experienced.

Twin 125-w 8-ft. fluorescent tubes in trough reflectors have been mounted at two levels, the upper layout serving to light the conveyors and to provide general illumination, the fittings at the lower level being for localized high-intensity lighting. The cleanliness of the foundry has permitted the use of fluorescent lighting for the cupolas and scrap bay. The core-benches, laboratories, control room and offices all have Osram 5-ft. fluorescent tubes in various types of fittings and tungsten fittings are used in the baths and changing rooms.

The installation was carried out by Platts' electrical staff and the architects were Elliot, Cox & Partners, London.

FIG. 1.—*The new lighting installations in Platts' Foundry.*

Publications Received

Economic and Commercial Conditions in Mexico (an overseas survey), by R. G. Stone, C.M.G., O.B.E. Published for the Board of Trade by Her Majesty's Stationery Office, York House, Kingsway, London, W.C.2; price 5s. 6d. net.

Mr. Stone has written a very interesting introduction to this Report and manages to recapture all the glamour normally to be associated with this colourful country. Only too often, Mexico is associated with revolutions and instability—conditions which to-day have been replaced by peaceful administration and prosperity. Whilst the iron and steel industry receives detailed consideration, the foundry industry is dismissed in a phrase appearing under a short paragraph on "General Engineering." The germane paragraph reads—"the range of general engineering industries is wide and expanding. Most types of foundrywork are carried out in a great number of foundries, both large and small." The reviewer is cognizant of the existence of a Chapter of the American Foundrymens' Society in Mexico City, so that actually the foundry industry of the country must be of considerable importance. Thus he would have welcomed more detailed information being given in the booklet as to the status of the foundry industry, for the Board of Trade must know that since the last war the British foundry equipment and supplies industry has been exporting in quite a large way. It is to be hoped that the next Report will remedy the deficiency. From the reading of this very interesting Report, there is every indication that this is a type of market which should be developed by UK producers.

High Conductivity Copper Alloys. Published by the Copper Development Association, 55, South Audley Street, London, W.1.

This interesting brochure covers four alloys—cadmium/copper, chromium/copper, silver/copper and tellurium/copper. They constitute a series about which knowledge is not too readily available. Three of the four are casting alloys, but the first one cited, cadmium/copper, is but rarely used in this form: Some useful information is given for makers of chromium/copper castings; this alloy gives every sign of being classified amongst those which are somewhat difficult to handle. Under this heading is illustrated a cylinder-head of an aircraft engine, which has every appearance of being a high-grade casting job, but which has actually been machined from a heat-treated forging.

The final alloy used in the form of a casting is tellurium/copper and here useful tips for the foundryman are included, but once again, the illustrations show components machined (probably) from forgings. This informative brochure which contains many tables of properties is available to readers on writing to the Association's new headquarters at South Audley Street.

Engineering Metallurgical Products. Issued by Duport, Limited, Tipton, Staffs.

This is a particularly well-illustrated brochure, covering, by means of illustrations of plant and products, the activities of the 16 firms comprising the Duport Group. The output is well varied, and includes castings, galvanized sheets, plastics, gears, rolled steel, electrical equipment, and cast fittings for chairs and the like. This type of brochure is of real value to the buyer, as it discloses a central source of supply, of which he is probably unaware, for a very diversified range of goods.

Steel Castings for Nuclear Power Plant. Issued by the British Steel Founders' Association, Broomgrove Lodge, Broomgrove Road, Sheffield, 10.

By excellent letterpress and illustrations in this 16-page bulletin, the reader is given a first-class general account of the whole subject. Yet, while the illustrations, especially those in the final section, do convey something of the nature of steel castings used, the text, somewhat to the reviewer's disappointment, merely states that the largest castings used in the construction of nuclear power plant are those which form the casings of the four blowers, and that the 54-in. valves in the circuit have to withstand 370 deg. C. Perhaps it is too early to expect data as to weights and numbers of steel castings incorporated in such plant.

New Catalogues

Hard-facing Welding Rods. Dewrance & Company, Limited, Great Dover Street, London, S.E.1, have prepared a four-page leaflet which lists eight types of hard-facing welding rods and indicates their composition; the colour of the packaging; the properties of the deposits; and the behaviour of the rods under various kinds of wear conditions, and finally their applications. The range carries the trade mark "Endewrance." Each type of rod carries a number, those below 100 being suitable for gas welding and those over 100 for arc welding. This useful leaflet is available to readers on writing to Great Dover Street.

Pyrometer-tip Tubes

A leaflet, reference A.E. 19/56, issued by the Morgan Crucible Company, Limited, Battersea Church Road, London, S.W.11, describes and illustrates the Morganite tip made from electrically-fabricated graphite. Data are given as to the number of immersions to be expected with various metals, they range from 80 with cupronickel to 100 with brass and bronze. A number of useful tips for the use and maintenance of these couple sheaths are given. The leaflet is available on application to Battersea.

Fractional-horse-power Motors. Lancashire Dynamo & Crypto, Limited, Trafford Park, Manchester, 17, in an eight-page catalogue, have used blue illustrations for a wide variety of machines, the electric motors being picked out by means of uncoloured patches. It is a very effective way of stressing what might otherwise be overlooked.

Book Review

Atlas of Enamel Defects. Published by the Institute of Vitreous Enamellers, secretaries, John Gardom & Company, Ripley, Derbyshire; price 42s. (members 10s. 6d.).

Recently, there has been a craze throughout the world for this type of publication. Its main advantage is in technical circles, particularly internationally, where the illustrations can give reality to conversation. The main disadvantages are that (1) it is bad business to publicize the fact that defects do occur in the output of an industry, and (2) from such a work in the hands of a user there is the ever-present fear of "a little learning being a dangerous thing." It is the considered opinion of the reviewer that this, and all similar types of publication, should be for private circulation only. For enamellers, the Atlas should be of great use, for the illustrations are clear and the causes of defects can be quite helpful in indicating a solution of the troubles.

V. C. F.

Personal

Mr. R. G. GALPIN has resigned as a director of Geo. W. King, Limited.

Mr. A. WRIGHT has been appointed secretary and commercial manager of H. W. Lindop & Sons, Limited, Walsall.

Mr. G. C. MOTT, financial controller of Philips Electrical, Limited, has been appointed a director of the company with effect from January 1.

Mr. RALPH D. PARKER, of Ontario, has been elected a director of the International Nickel Company of Canada, Limited. Mr. Parker succeeds Mr. J. S. Duncan.

Mr. R. T. DE POIX, managing director of Henry Gardner & Company, Limited, has been elected chairman of the Zinc Development Association for 1957.

Mr. H. R. NEWMAN, general manager of the Butterley Company, Limited, and Mr. E. R. ROBERTSON, the company's chief engineer, are making a business trip to Calcutta.

Mr. ARNOLD CARR, assistant managing director of Thomas W. Ward, Limited, Sheffield left England by air on January 9. He is visiting Australia and the USA on business.

Mr. R. WRIGHT has succeeded Mr. J. WILSON as engineering castings representative in Scotland for the Carron Company, ironfounders, engineers, etc., of Carron (Falkirk).

Mr. J. A. GREAVES, manager of the engineering interests in Scotland of Thos. W. Ward, Limited, has received presentations to mark the completion of his 50 years' service with the firm.

Mr. J. E. CURRIE, chairman of Catalin, Limited, has been appointed joint managing director with Mr. A. J. PERRYMAN. Mr. Perryman, who joined the company in 1937, was previously general manager.

Mr. JOHN KAY has been appointed as West of England representative for Martonair, Limited, of Richmond, Surrey. Mr. Kay was previously a member of the technical staff at the Richmond, head office of the company.

Mr. DONALD L. CAMPBELL, M.A., director of Efco, Limited, and Metallurgical Equipment Export Company, Limited, leaves on February 7 on a tour which will include visits to India, the Far East, Philippines, Australia, Canada and the USA.

Mr. J. ROY GORDON has been elected executive vice-president of the International Nickel Company of Canada, Limited. Mr. Gordon has also been elected executive vice-president of the International Nickel Company, Inc., the company's subsidiary in the United States.

The RT. HON. R. R. STOKES, M.P., chairman and managing director of Ransomes & Rapier, Limited, and managing director of Cochran & Company (Annan), Limited, left London last week for a short visit to Beirut and Baghdad to help foster the company's business in the Middle East.

Mr. ERIC DENNIS has been appointed a director of Automotive Engineering, Limited, a subsidiary of Sheepbridge Engineering, Limited. Mr. Dennis, who joined the company as a jig and tool draughtsman in 1920, graduated through all phases of management, and for many years was general manager.

Mr. H. PATTISON F.C.W.A., A.M.I.I.A. has been appointed deputy secretary to General Refractories Limited, Sheffield, following the recent death of Mr. Donald Morris. Mr. GORDON LEDINGHAM, Associateship in Engineering, Sheffield University, has been appointed to the position of chief engineer of the company.

Mr. STANLEY BROOKE, managing director of the Oughtibridge Silica Firebrick Company, Limited, Sheffield, has retired after 45 years with the company which was founded by his grandfather nearly a century ago. Mr. F. W. LEDGER, secretary of the company, has also retired after 49 years in the position.

Mr. MILES BEEVOR, deputy chairman and joint managing director of the Brush Group, has relinquished his post of joint managing director; he remains as deputy chairman. Mr. IAN T. MORROW has been appointed managing director and Mr. CHARLES BARNARD has been appointed to the board of the group, with special responsibilities for their heavy engine factories. Mr. M. C. CLEAR has been appointed to the board as director in charge of exports.

Dr. G. TUGENDHAT has resigned as deputy chairman of Manchester Oil Refinery (Holdings) and has been appointed managing director; he is succeeded as deputy chairman by Major-General L. O. LYNE. Mr. S. R. JARVIE and Mr. J. C. WOOD-MALLOCK have been elected to the board of Manchester Oil Refinery (Holdings), have also been appointed joint general managers of the following companies:—Manchester Oil Refinery, Manchester Oil Refinery (Sales), Raven Oil, Trafford Chemical Developments and Petroleum Inventions.

Mr. AMBROSE FIRTH, chairman of Brightside Foundry & Engineering Holdings Limited, made the first double presentation of gold watches to two members of the staff of Moorwoods Limited, cooking equipment manufacturers, Harleston Street, Sheffield, on January 10. The recipients were Mr. FRANK WRAGG, who started with the company in 1901 and retired on December 31, and Mr. JOHN WEBSTER, aged 70, who started with the firm in 1903 and is still working. Moorwoods are members of Brightside Foundry & Engineering Holdings, Limited.

After 57 years in ironfounding, Mr. HUBERT SHEPHERD, of the Sinclair Iron Company, Ketley, recently retired at the age of 70. Mr. Shepherd who commenced work at the age of 13 in the foundry of the Horsehay Company, was subsequently employed with James Clay (Wellington) Limited, where he became foundry manager, and later joined the Stanton Ironworks Company, Limited, in the same capacity. He transferred to the Coalbrookdale works, returning to the Sinclair concern six years later. He received presentations from the management and staff of Allied Ironfounders, Limited, and from the employees of the Sinclair Iron Company.

Mr. W. J. POOL, until recently manager of the industrial engineering department of the British Thomson-Houston Company, Limited, Rugby, is to devote his full time in future to special duties with the company. Mr. Pool, who joined BTH in the test department at Rugby in 1914, became a member of the industrial engineering staff in 1919 and succeeded the late Mr. R. D. Given as manager of the industrial engineering department in 1941. He has studied problems associated with nuclear power projects in recent times and it is to enable him to give his full time to such projects that he has relinquished the managership of the industrial engineering department. The new manager is Mr. W. SPENCE.

News in Brief

AFTER 29 years of existence, *Canada's Foundry Journal* has ceased publication.

THIS YEAR THE LEIPZIG SPRING FAIR is to feature foundry machinery and equipment. Details of the fair are obtainable from the Messeamt, Post Box 329, Leipzig C.1, East German Republic.

Mr. K. KLOUMAN, vice-chairman of J. Blakeborough & Sons, Limited, Brighouse, said at a recent dinner held at the works, that the company had on their books orders to the value of £3,000,000.

THE EIGHTH in the annual series of "Minibitions" organized by the Purchasing Officers' Association, and held concurrently with its national conference, will take place at the Hotel Metropole, Folkestone, from September 26 to 28.

VACU-BLAST LIMITED, manufacturers of mobile dust-free shotblast machinery have established a company in France. The company is known as Societe Vacu-Blast (France) and its address is 46, Rue Anatole France. Levallois-Perret (Seine), France.

A NEW COMPANY, Willetts Engineering, Limited, Midland Bank Chambers, High Street, Lye, near Stourbridge, has been formed for the manufacture of welded chaplets, which were shown at the exhibition held in Düsseldorf, by their associated company, Industrial Foundry Materials, Limited.

Mr. J. D. MCFARLANE, who has spent his working career in the foundry industry, recently being works manager at Ardeer Foundry Company, Limited, has been appointed sales and technical representative for Scotland for Production Chemicals (Rochdale) Limited. a firm producing a range of bentonites.

Mr. J. S. SINTON has been elected president of the Steel and Engineering Industries Federation of South Africa. He is chairman and managing director of Haggie, Son & Love (1936) Limited, and deputy chairman and managing director of African Wire Ropes, Limited.

MR. A. ROEBUCK recently gave a dinner to the first team of Hadfields, Limited, to win the H. L. Brown Shield, the premier award in competitive ambulance work in the Sheffield district. It was in fulfilment of a promise made 20 years ago when Mr. Roebuck was a director of Hadfields and also president of the Sheffield Association of Sports Clubs.

FOLLOWING FURTHER NEGOTIATIONS with Crofts (Engineers), Limited, power transmission engineers, Thornbury, Bradford, the Bradford Corporation Markets and Fairs Committee now proposes that the Bradford Moor fairground, adjoining the Crofts' works, be leased to them for 99 years, with the exclusion from the lease of a small portion of the fairground used as a caravan park.

A NEW HEATING DIVISION of Birlec, Limited, has been formed by the amalgamation of the furnace and induction-heating divisions under the management of Mr. J. M. Paton, and Mr. D. A. Hackett has been appointed sales manager of the new division. A new engineering department has also been formed by the amalgamation of divisional drawing offices, under Mr. G. H. Shirley as chief engineer.

TWO WATER-WHEELS used by the D.P. Battery Company at Bakewell, Derbyshire, since 1898 to generate electricity, have just been removed. They date back to 1827 and 1852 and the earlier one is 25 ft. dia. and has 70 buckets. The building is a former cotton mill built by Sir Richard Arkwright in 1777. The wheels have been removed because the company has installed hydro-electric plant.

THE ASSOCIATED ELECTRICAL INDUSTRIES LIMITED, John Thompson Nuclear Energy Company Limited, and the Morgan Crucible Company Limited, are forming a joint company, Nuclear Graphite Limited. This company will specialize in the machining of graphite blocks for the construction of the massive graphite moderator piles in atomic reactors—similar reactors to those in use at Calder Hall.

IN CONNECTION with the railway modernization plan British Transport Commission have placed a contract with the Drewry Car Company, London, for engine transmission and control equipment for 21 200-h.p. diesel-mechanical shunting locomotives to be built in British Railways workshops at Swindon, and the Gloucester Carriage & Wagon Company, Limited, are to supply 41 centre-gangway second-class brake carriages.

ONE-DAY CONFERENCES organized by the Industrial Welfare Society (Inc) include "The Needs of Young Workers" on January 23; "Electronics in the Office," February 12, and "Women in Supervisory and Management Posts," on February 13. These three conferences will be held at Robert Hyde House, 48, Bryanston Square, London, W.1, and a fourth, entitled "Hygiene and Cleaning in Food Factories," will take place on February 28 at the Midland Hotel, Manchester.

ENGLISH STEEL CORPORATION, LIMITED, have ordered a new electric-arc furnace to augment the production of alloy steel at their Openshaw works. The new furnace to be supplied by Birlec, Limited, will have a shell diameter of 15 ft., giving a nominal charge capacity of 30 tons. A transformer rated at 10,000 kva and fitted with on-load tap-changing gear, will give the furnace a high melting rate. Standard top-charging and counter-balanced electrode-control features are provided.

EXECUTIVES of Empresa Municipal de Transportes de Madrid, the concern responsible for the operation of Madrid's city transport, which recently placed an order valued at nearly £1,000,000 for British single- and double-decked buses, last week saw some of these chassis being completed on the assembly lines of Leyland Motors, Limited. Later they visited the works of Metropolitan-Cammell-Weymann, at Elmdon, where they saw the double-deck bodywork being mounted.

THE INSTITUTION OF STRUCTURAL ENGINEERS expect that a report of the research work carried out under the first award of the Research Scholarship, made in 1954, will be published towards the end of the present year. The conditions of this Scholarship have recently been revised and it is now open for award every third year for a two-year period, the value of the Scholarship being £600 per year. It is the intention of the Institution to make the next award of the Scholarship in 1957.

HUDSWELL, CLARKE AND COMPANY, LIMITED, locomotive engineers, of Hunslet, Leeds, have secured a £200,000 contract for eight main-line diesel-hydraulic locomotives for the Sierra Leone railway. This locomotive, which has been developed by the Leeds firm during the last four years, has undergone extensive trials, and the present contract is the outcome of its successful performance. The firm recently supplied a number of other diesel locomotives to the Sierra Leone railway.

AS A RESULT of the decision to move the existing Buckhaven (Fife) High School organization to new premises, near Methilhill, in the summer, the technical college will be replanned and re-equipped so that

News in Brief

students will be able to take courses for national certificates and other awards hitherto beyond the scope of the college. Plans for expansion provide for the setting up of an electrical installation workshop and for more facilities for students of chemistry and chemical engineering. Apprenticeship courses as well as day-release classes in commercial subjects are also planned.

BRITISH OXYGEN GASES, LIMITED, announce that three new permanent stores have been established for the supply of compressed oxygen and dissolved acetylene. The stores are at the premises of Highland Haulage, Limited, Longman Garage, Inverness; D. M. Wallace & Sons, Limited, Bowmount Engine Works, Kelso; and Londonderry & Lough Swilly and Letterkenny Railways, Londonderry. Arrangements for customers to take supplies from these stores will be made by the sales department of British Oxygen's Scottish district, the headquarters of which are at Polmadie, Glasgow.

AT a British Institute of Management forum held in Birmingham on January 16, Mr. A. J. Nicol, personnel director of Joseph Lucas, Limited, and Mr. Jack Williams, of the Transport and General Workers' Union, both testified to an improvement in industrial relations and to a new willingness on the part of trade unions and employers to work together in times of difficulty. There were definite signs that the improved industrial atmosphere was passing its first severe test imposed by the present recession in Midland industry, it was stated. Agreement came also from Mr. J. A. Hunt, general manager of the Hymatic Engineering Company, Limited, Redditch, and Mr. R. Scott Robinson, a director of Tubes, Limited.

THE ELECTION OF Mr. Robert Garland, a Glasgow shop steward, as national organizer of the Amalgamated Union of Foundry Workers has been declared null and void. This was announced on January 16 by the Union's national executive following a trade union inquiry into the election by a three-man arbitration court. They considered an appeal by the defeated candidate, Mr. F. Bullock, against Garland's election. Bullock claimed that there had been gross interference by an outside body on behalf of one candidate; that there was violation of the rules involving canvassing, and that the ballot was not conducted in accordance with union rules. As a result of the court's decision new nominations are to be asked for and a new election held.

TECALEMIT (A'ASIA) PTY., LIMITED, a subsidiary of Tecalemit Limited, Plymouth, have supplied a number of special mobile servicing trucks to the Kwinana Construction Corporation for servicing the plant, machinery and vehicles at the Maralinga Rocket Projectile test site in North West Australia. These vehicles embody self-reeling hose reels for greasing and dispensing a number of gear and engine oils. A 300-gallon diesel-fuel tank is mounted across the front of the truck which is fitted with a semi-rotary dual bowl pumping system incorporating a Tecalemit Hydrolock filter. Twelve similar mobile servicing units, built on British 4-ton Bedford chassis, also have been supplied to the Highways Department of South Australia to provide lubrication and servicing in the "field."

AS PART of the new export drive of the Standard Motor Company, Limited, the following tours by senior executives have been arranged: Mr. Alick S. Dick, managing director, is to leave in February for a round-the-world tour accompanied by Mr. Michael Whitfield, general sales director, and it is expected that they will be away for two months during which time they will visit India, Australia, and Canada. Mr. J. A. Christensen, export commercial manager of the company, is at present on a visit to Mexico and is to continue with a tour of South America, while zone controller, Mr. D. Gower Johnson, is now touring the Caribbean area and the Central American states. Mr. C. L. P. Edmonds, export sales manager, left in mid-January for a visit to Scandinavia, and at the end of this month Mr. W. J. R. Warren, director of export sales, flies to Ceylon and India.

CONTROLLED STRETCHED DURALUMIN PLATES, which were previously available only from the United States, are now being manufactured in this country by a special process developed by James Booth & Company, Limited, Argyle Street Works, Birmingham, 1. The company has recently supplied to a British aircraft constructor a number of these plates—some of which are believed to be the largest of their kind ever used in this country. The largest plates were 25 ft. 4 in. long, 2 ft. 8 in. wide and 2 in. thick, weighing 1,880 lbs. each, and, in spite of their size, all had been subjected to a controlled stretching operation to eliminate the internal stresses occasioned by heat-treatment. This method of operation enables plates to be machined without subsequent distortion. To ensure that the finished plates were free from internal defects, they were examined by ultrasonic methods at two stages—first as a cast ingot and later as a finished plate.

THE BRITISH TRANSPORT COMMISSION have placed contracts worth £8,000,000 for electrical equipment, some of which will form the rolling stock of the Glasgow suburban railways under the scheme of electrification authorized last April. One of the contracts, placed with Metropolitan-Vickers, Limited, will provide the equipment for 91 multiple-unit trains. Each unit comprises three cars and may be coupled up to form six- or nine-coach trains. Track preparation for the scheme involves the raising of 121 bridges, and 61 footbridges crossing the tracks, or the lowering of the tracks below them, to accommodate overhead wiring. Power will be taken from the national grid by overhead wire conduction, a system pioneered by the French National Railways and adopted by British Railways after an experiment on the line between Lancaster, Morecambe and Heysham. Other firms concerned in the contracts are the B. T. H. Company, Limited, E. E. C. Limited, and G. E. C. Limited. The engineering difficulties are greater south of the Clyde, and the work on the north side is therefore expected to be completed first. The Glasgow suburban scheme is the first stage of a plan which envisages the electrification of a further 119 miles of railway routes from Glasgow to Gourock, Wemyss Bay, Kilmalcolm, Kilmarnock, East Kilbride, and Motherwell.

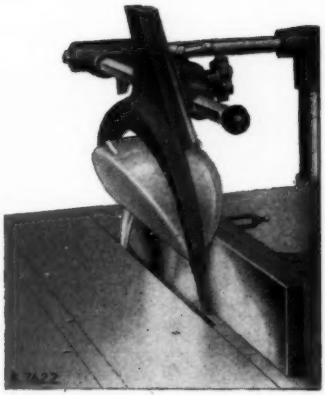
Obituary

Mr. H. DUDLEY CAMPBELL, a director for many years of Shaw Glasgow, Limited, ironfounders, died on January 14. He joined the company in 1912 and retired in 1946.

Mr. ARTHUR JOHN BEELEY, steel production manager of Edgar Allen & Company, Limited, Sheffield, has died at the age of 65. He joined the firm in 1915 and gained an Associateship in metallurgy in 1922 after studying at Sheffield University. He also won a first-class Iron and Steel Federation award on the technology of iron and steel production the same year. In 1946 he was admitted a Fellow of the Institute of Metallurgists.

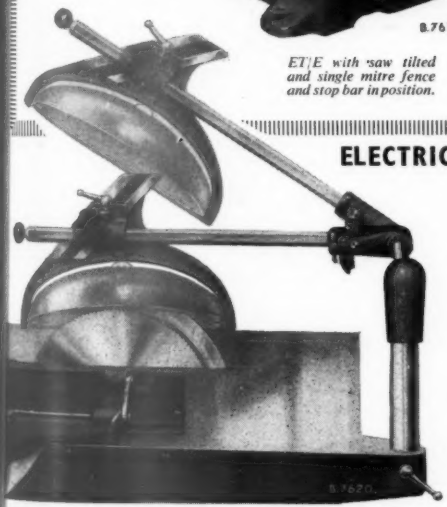
An adjustable stop limits the movement of the rolling table, and for constant repetition work acts as a rebound buffer.

The tilting saw guard cowl yields with the fence adjustment and returns automatically.



ET/E with saw tilted and single mitre fence and stop bar in position.

The combined stop/brake lever can be knee-operated whilst both hands hold the workpiece for safety.



The saw guard is adjustable vertically and horizontally, and can be quickly lifted out of the way when required.

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Raw Material Markets

Iron and Steel

The position among the foundries shows little change, the demand for castings being on much the same lines as in recent weeks. Some sections of the engineering and speciality foundries are faring better than other units; demands for castings continue at a good level from collieries and steelworks, machine-tool makers, power and electrical plant manufacturers, and general engineers. Those supplying castings mainly for the motor vehicle trade are not receiving sufficient orders to keep plants fully employed, and many are on short time. Orders being placed fall far short of previous schedules and little improvement can be foreseen in the near future.

In the light-castings trade, some foundries are much better employed than others, but there is overall room for improvement. Orders being placed are readily completed, so that the foundries are unable to add appreciably to forward commitments. The textile foundries are in need of more work, but the jobbing foundries are fairly busy, supplying castings to many and varied trades. Little difficulty is experienced in obtaining the required supplies and grades of pig-iron. The supply of the low- and medium-phosphorus iron and hematite to the engineering and speciality foundries is adequate and there appears to be no desire to add to stocks. In fact, some of the foundries (chiefly those connected with the motor-car industry) are not taking up the full quantities of pig-iron which producers are offering.

Refined irons are readily available, as home demand is quiet and producers continue to ship consignments overseas. The supply of high-phosphorus pig-iron to the light, jobbing, textile, and some of the engineering foundries, has improved recently. Additional supplies have become available by the changing over temporarily of a furnace from basic to high-phosphorus foundry iron, and this has enabled producers to clear off their commitments. Demands for high-phosphorus pig-iron are not heavy, but are sufficient to absorb current make, coupled with the consignments which are shipped abroad.

Foundry coke is coming forward in adequate quantities to satisfy demands. The foundries appear to be well supplied with scrap, and they have no difficulty in obtaining supplies of ganister, limestone, and firebricks.

Re-rollers continue to be well employed and home demands are maintained for their outputs of small bars, light sections, etc. Heavy demands continue for small rounds for reinforcing. Any tonnages which can be spared are easily disposed of to buyers overseas. Generally, the re-rollers are well supplied with steel semis, but stocks on hand have been depleted. Home steelworks continue to send forward regular consignments, but in many instances these are insufficient to cover usage, particularly in small billets of 2 in. sq. and 2½ in. sq. There is also pressure for increased quantities of carbon and alloy steels.

Non-ferrous Metals

Prices of non-ferrous metals show no rhyme or reason to indicate any kind of trend. Generally speaking, the basic economics of the case are not too good and the temptation is always present to be bearish about the outlook. However that may be, there are special factors operating which, one way and another, militate against any sharp price decline.

In copper, demand is only modest and production continues to outstrip consumption. Consequently, the price is falling—but only gradually. Bullish points in the offing include the unrest on the Rhodesian Copperbelt over the rejected wage claim for 6s. 8d. per shift, the indication (it is stronger than a rumour) that the US Government will begin stockpiling copper again, and there is, too, the fact that the Japanese Ministry of Trade has permitted the Japanese copper consumer industries to engage in restricted hedging operations on the London Metal Exchange, for which purpose an allocation of some $300,000 has been made. In the United States the position is unchanged. Producers are quoting 36 cents, custom smelters 35 cents, and the export price is still hovering around 34½ cents, with No. 2 scrap selling for about 28 cents a pound. Demand is quiet. The automotive industry is not selling its new models well enough for it to be shouted from the headlines, and stocks are still accumulating.

Tin is reasonably firm on both sides of the Atlantic. The chief explanation is the continued strike at the Butterworth smelter in Malaya which began on January 10. The fear there is that the strike might spread. This has kept the price firmer than it would have been otherwise, although the drop in stocks in LME warehouses to a mere 636 tons is an important factor. In America the price is now comfortably clear of the $100 per pound level.

Lead continues a steady market in both London and New York. In London the market showed its pleasure at the news that US buying for barter transactions is to begin again, and the price is firm despite a drop in total demand. In the US the quotation continues at 16 cents a pound and will obviously stay there under the impetus of foreign buying of foreign metal through barter transactions. On the other hand, the recent figures of consumption from the battery manufacturers reveal that buying from that sector is entering its seasonal trough.

Zinc is steady, despite the settlement of the CPR strike and that of the American Smelting & Refining's plant at Corpus Christi. The news that US purchases would be restarted for foreign metal *via* bartering for agricultural surpluses pushed the price up last week to £106 a ton, the highest level since free dealings in the metal began four years ago. The price, since then, has come back somewhat, although it shows strong resistance to easing to lower levels. Demand from die-casters has not been prominent recently, but the American Die Casting Institute expects that consumption this year will reach a new high. This is predicted, presumably, on the known fact that the new automobile models will use considerably more zinc, as will domestic appliances. At the moment, however, buying is mainly coming in for "Prime Western" at 13½ cents per pound, East St. Louis.

Contracts Open

The dates given are the latest on which tenders will be accepted. The addresses are those from which forms of tender may be obtained. Details of tenders with the reference ESB can be obtained from the Board of Trade Export Services Branch, Lacon House, Theobalds Road, London, W.C.1 (telephone: CHAncery 4411, ext. 738 or 771), unless otherwise stated.

BELFAST, January 28—Iron and steel; iron castings, etc., for 12 months from June 1, for the City Council. The City Surveyor, Room 84, City Hall, Belfast.

CAMBRIDGE, January 26—Cast-iron kerb outlets; gully grates and frames during the year ending March 31, 1958, for the Cambridgeshire County Council. The City Surveyor, Shire Hall, Cambridge.

COVENTRY, January 31—Iron castings, tools, etc., for the year ending March 31, 1958, for the Corporation. The City Engineer, Council House, Coventry.

FAILSWORTH, February 5—Cast manhole covers and frames; cast-iron gully grids, etc., for the year ending March 31, 1958, for the Urban District Council. The Engineer and Surveyor, Town Hall, Failsworth, near Manchester.

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Current Prices of Iron, Steel, and Non-ferrous Metals

(Delivered unless otherwise stated)

January 23, 1957

PIG-IRON

Foundry Iron.—No. 3 IRON, CLASS 2:—Middlesbrough, £20 1s. 0d.; Birmingham, £19 13s. 3d.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, £21 18s. 0d., delivered Birmingham. Staffordshire blast-furnace low-phosphorus foundry iron (0.10 to 0.50 per cent. P, up to 3 per cent. Si), d/d within 60 miles of Stafford, £22 2s. 3d.

Scotch Iron.—No. 3 foundry, £23 4s. 6d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, £24 6s. 6d.; South Zone, £24 9s. 0d.

Refined Malleable.—P, 0.10 per cent. max.—North Zone, £25 14s. 0d.; South Zone, £25 16s. 6d.

Hematite.—Si up to 2 per cent., S. & P. over 0.03 to 0.05 per cent. :—N.-E. of England (local iron), £22 17s. 6d.; Scotland (Scotch iron), Zone S. 1, £23 4s. 0d.; Sheffield, £24 4s. 6d.; Birmingham, £24 12s. 0d.; Wales (Welsh iron), £22 17s. 6d.

Basic Pig-iron.—£19 3s. 0d. all districts.

FERRO-ALLOYS

(Per ton unless otherwise stated, delivered)

Ferro-silicon (6-ton lots and over).—45 per cent. Si. £50 0s. 0d. to £51 15s. 0d., scale 17s. 0d. to 17s. 6d. per unit; 75 per cent. Si, £70 0s. 0d. to £75 7s. 6d., scale 17s. 0d. to 17s. 6d. per unit.

Ferro-vanadium.—50/60 per cent., 28s. 6d. per lb. of V.

Ferro-molybdenum.—65/75 per cent., carbon-free, 12s. 3d. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, £250 0s. 0d.; 38/40 per cent., £299 0s. 0d.

Ferro-tungsten.—80/85 per cent., 14s. 10d. per lb. of W.

Tungsten Metal Powder.—98/99 per cent., 17s. 10d. per lb. of W.

Ferro-chrome (6-10 ton lots).—4/6 per cent. C, £96 0s.0d. to £96 10s. 0d., basis 60 per cent. Cr, scale 33s. 0d. to 31s. 0d. per unit; over 6 per cent. C, £94 0s. 0d. to £95 10s. 0d., basis 60 per cent. Cr, scale 31s. 0d. per unit; 2 per cent. C,* 2s. 1½d. per lb. Cr; 1 per cent. C,* 2s. 2d. per lb. Cr; 0.15 per cent. C,* 2s. 2½d. per lb. Cr; 0.10 per cent. C,* 2s. 2¾d. per lb. Cr; 0.06 per cent. C,* 2s. 3d. per lb. Cr.

Metallic Chromium.—98/99 per cent., 7s. 0d. to 7s. 6d. per lb.

Metallic Manganese.—90/92 per cent., carbon-free, £290 0s. 0d.; 96/98 per cent., £310 0s. 0d.

Ferro-columbium.—65/75 per cent., Nb + Ta, 22s. 6d. to 23s. 6d. per lb., Nb + Ta.

Ferro-manganese (home).—78 per cent., £75 0s. 0d.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms, and Slabs.—BASIC: Soft, u.t., £30 9s. 0d.; tested, 0.08 to 0.25 per cent. C, £31 9s. 0d.; hard (0.41 to 0.60 per cent. C), £32 10s. 6d.; silico-manganese, £41 0s. 0d.; free-cutting, £34 13s. 0d. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £38 4s. 6d., silico-manganese, £41 7s. 6d.

Billets, Blooms, and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £36 3s. 6d.; basic, hard, over 0.41 up to 0.60 per cent., C, £37 6s. 0d.; acid, up to 0.25 per cent. C, £40 7s. 6d.

FINISHED STEEL

Heavy Plates and Sections.—Ship plates (N.-E. Coast), £39 2s. 0d.; boiler plates (N.-E. Coast), £41 12s. 0d.; floor plates (N.-E. Coast), £40 11s. 0d.; sectional material, N.-E. Coast, £37 11s. 6d.

Small Bars, Sheets, etc.—Rounds and squares, under 3 in., untested (4-ton lots), £37 18s. 0d.; flats, 5 in. wide and under (4-ton lots), £37 18s. 0d.; hoop and strip, £37 17s. 6d.; uncoated strip mill coils, hot rolled, under 3mm. to 12g, £41 6s. 0d.; black sheets (hand mill), 17/20 g., £52 4s. 6d.; galvanized corrugated sheets, 24 g., £65 9s. 0d.

Alloy Steel Bars.—1 in. dia. and up: Nickel, £64 13s. 9d.; nickel-chrome, £88 15s. 3d.; nickel-chrome-molybdenum, £100 13s. 9d.

NON-FERROUS METALS

Copper.—Cash, £263 0s. 0d. to £263 10s. 0d.; three months, £262 0s. 0d. to £262 10s. 0d.; settlement, £263 10s. 0d.

Copper Tubes, etc.—Solid-drawn tubes, 2s. 6⅞d. per lb.; rods, 301s. 6d. per cwt. basis; 20 s.w.g., 334s. 9d. per cwt.

Tin.—Cash, £802 0s. 0d. to £804 0s. 0d.; three months, £775 0s. 0d. to £777 0s. 0d.; settlement, £804 0s. 0d.

Lead (Refined Pig).—Second half January, £116 0s. 0d. to £116 5s. 0d.; second half April, £114 0s. 0d. to £114 5s. 0d.

Zinc.—Second half January, £104 0s. 0d. to £104 5s. 0d.; second half April, £99 10s. 0d. to £99 15s. 0d.

Zinc Sheets, etc.—Sheets, 15 g. and thicker, all English destinations, £135 10s. 0d.; rolled zinc (boiler plates), all English destinations, £133 5s. 0d.; zinc oxide (Red Seal), d/d buyers' premises, £110.

Brass Tubes, etc.—Solid-drawn tubes, 2s. 2¾d. per lb.; rods, drawn, 3s. 0⅞d.; sheets to 10 w.g., 227s. 9d. per cwt.; wire, 2s. 10⅜d.; rolled metal, 227s. 9d. per cwt.

Brass (Brazing).—BS1400, B3 (65/35), £202; B6 (85/15), —; BS249, —.

Brass (High Tensile).—BS1400, HTB1 (30 tons), £258; HTB2 (38 tons), £268; HTB3 (48 tons), —.

Gunmetal.—BS1400, LG2 (85/5/5/5), £274; LG3 (86/7/5/2), £284; G1 (88/10/2/½), £340; (88/10/2/1), £325.

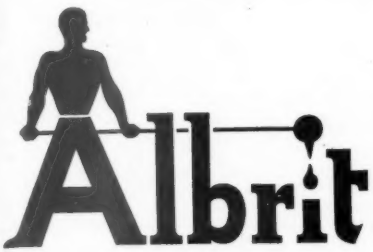
Phosphor Bronze.—BS1400, PB1 (AID released), £347 per ton.

Phosphor Bronze Strip, etc.—Strip, 318s. 6d. per cwt.; sheets to 10 w.g., 318s. 6d. per cwt.; wire, 4s. 3½d. per lb.; rods, 3s. 7d.; tubes, 3s. 5½d.; chill cast bars: solids 3s. 7d., cored 3s. 8d. (CHARLES CLIFFORD, LIMITED).

Nickel Silver, etc.—Rolled metal, 3 in. to 9 in. wide × 0.056, 4s. 0½d. per lb.; round wire, 10g. in coils (10 per cent.), 4s. 5½d.; special quality turning rod, 10 per cent., ½ in. dia., in straight lengths, 4s. 4½d. All prices are net.

Other Metals.—Magnesium, ingots, 2s. 5½d. per lb. Antimony, English, 99 per cent., £210 0s. 0d. Quicksilver, ex-warehouse, £84 10s. 0d. to £84 15s. 0d. Nickel, £600 0s. 0d. Aluminium ingots, £197 0s. 0d.; aluminium bronze (BS1400), AB1, £285; AB2, —. Solder, brazing, BS1945, type 8 (50/50), 3s. 1d. per lb., type 9 (54/46), 3s. 4½d. per lb.

* Average 68-70 per cent



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Central 9969

Company News

HENRY BERRY & COMPANY, LIMITED, hydraulic engineers, of Hunslet, Leeds—A one-for-one scrip issue and sub-division in shares of 5s. denomination is announced.

A. E. GRIFFITHS (SMETHWICK), LIMITED, industrial oven builders, etc., of Handsworth, Birmingham—An extra-ordinary meeting is called for January 30 to create capital and affect a one-for-three scrip issue.

UNITED GAS INDUSTRIES, LIMITED—Interim dividend on the £778,669 ordinary capital is reduced from 4¼ to 3¼ per cent. for the year to March 31, 1957. For 1955-56 the ordinary total was 14 (13) per cent. Hoiders of the £27,296 deferred received 112½ (85) per cent.

RICHARDSONS, WESTGARTH & COMPANY, LIMITED—The offer to acquire the share capital of the Humber Graving Dock & Engineering Company, Limited, Immingham (Lincs), has been accepted by shareholders holding 99.73 per cent. of the capital and the offer is declared unconditional. Non-renounceable allotment letters regarding the resulting Richardsons, Westgarth & Company shares have been posted.

TECALEMIT, LIMITED, hydraulic and filtration engineers, of Brentford (Middx)—A final dividend of 10 per cent. makes 13 per cent. (same) for the year to July 31, 1956. After tax of £199,451 (£166,729) and transferring £10,000 (£12,000) from tax equalization account, the group net profit is £160,437. For the previous year the net balance was £157,347 and included a £10,000 tax credit adjustment.

CHARLES ROBERTS & COMPANY, LIMITED, rail- and road-vehicle manufacturers, etc., of Wakefield (Yorks)—An ordinary interim dividend of 4½d. per 5s. stock unit, less tax, has been declared. It is proposed to distribute 1½d. per unit, not subject to tax, from realized capital accretions. For the previous year, to March 31, 1956, payments comprised a less-tax interim of 4½d. plus a special centenary distribution of 1s. per unit, not subject to tax, out of capital surplus, and a final of 4½d., less tax, plus 1½d., not subject to tax, from capital accretions.

AITON & COMPANY, LIMITED, pipework specialists and ironfounders, of Derby—Profits in the first half of the year to March 31, 1957, were greater than in the similar period of 1955-56 due to old long-term contracts being brought to account. Few remain unaccounted for. Results achieved on newer and shorter-dated contracts continue to be satisfactory and an unchanged 7½ per cent. interim dividend is being paid. Competition, particularly overseas, is becoming more severe and the necessity of keeping down export prices in the face of rising costs is liable to cut into profit margins. Reasonable profits can be expected to continue.

IMPERIAL CHEMICAL INDUSTRIES, LIMITED—Applications totalled 67,803, for £238,069,150 of stock in respect of the company's £40,000,000 loan stock offer to shareholders and employees. The issue is in 5½ per cent. convertible unsecured loan stock, 1977-79, at a price of 96. The basis of allotment is as follows:—Applications (26,723) for £200 or less have been allotted in full. Applications (39,274) for £250 to £10,000 (both inclusive) have been allotted the first £200, plus one-eighth of the balance of stock applied for. Applications (1,806) for more than £10,000 have been allotted one-eighth of the amount of stock applied for, with a minimum of £1,450. Allotments have been made to the nearest £50.

RICHARD THOMAS & BALDWINS, LIMITED—The manufacturing and trading profit of the group for the year to September 29, 1956, amounted to £10,075,840, against £11,299,650. After adding other income, providing for depreciation £2,008,490 (£1,742,862) and for taxation £4,056,397 (£4,443,168) there remains a balance of £4,313,848 (£5,578,252). Profit available to the parent company, after including £265,000 (£885,000) taxation unrequired, was £4,428,068 (£6,354,706). Dividends paid and recommended, amounting again to 13½ per cent., required £840,576 as previously, and £1,200,000 (£1,660,000) has been transferred to fixed assets replacement. A further transfer of £1,866,439 (£3,124,785) has been made to general revenue reserve and £305,000 (£478,000), representing the reduction in tax attributable to investment allowances, has been transferred to investment allowances reserves. The surplus carried forward was £7,488,464 (£7,191,971).

Forthcoming Events

JANUARY 28

Institute of British Foundrymen

Sheffield and district branch:—Annual dinner at the Royal Victoria Hotel, 7 for 7.30 p.m.

Incorporated Plant Engineers

Birmingham branch:—"Fire Prevention," by G. F. Goodman, 7.30 p.m., at the Imperial Hotel, Temple Street.

Institution of Works Managers

Glasgow branch:—"Work Study," by J. B. Kitchin, 7.30 p.m., at the Institution of Engineers and Shipbuilders in Scotland, 39, Elmbank Crescent.

JANUARY 29

Institution of Works Managers

Birmingham branch:—"Training of Technologists," by H. J. Shelley, C.B., O.B.E., 7 p.m., at the Midland Institute, Paradise Street.

JANUARY 30

Institute of British Foundrymen

London branch:—"High-duty Iron-castings Production," by C. R. van der Ben, 7.30 p.m., at the Constitutional Club, Northumberland Avenue, London, W.C.2.

Association of Bronze & Brass Founders

London area:—Members meeting at the Clarendon Restaurant, Hammersmith, 2 p.m., when there will be a discussion of the Association's activities and a talk by Mr. E. C. Mantle on the work of the British Non-Ferrous Metals Research Association.

JANUARY 31

Institute of Vitreous Enamelling

Midland section:—"Sheet-iron Enamelling," by Mr. G. A. Greenwell, 7.30 p.m., at the Birmingham Exchange and Engineering Centre, Stephenson Place.

Incorporated Plant Engineers

Sheffield and district branch:—"Care and Maintenance of Wire Ropes," 7.30 p.m., at the Grand Hotel, Sheffield.

FEBRUARY 12 to 13

Birmingham and District Industrial Training Centre

Course on "Use and Maintenance of Lifting Machinery." Details from the secretary, W. G. Appleyard, 21, Steelhouse Lane, Birmingham, 4.

Iron & Steel Export Licensing

Licences will in future be required for the export to all destinations of all types of pig-iron, steel rails, and alloy and non-alloy steel sections, bars, and rods. The Board of Trade states that this decision has been made as a result of recommendations by the Iron and Steel Board "to safeguard supplies of steel for the UK constructional, engineering, and shipbuilding industries."

The amending order is the Export of Goods (Control) (Amendment No. 2) Order, 1957 (SI 1957, No. 39), which came into effect on Monday.

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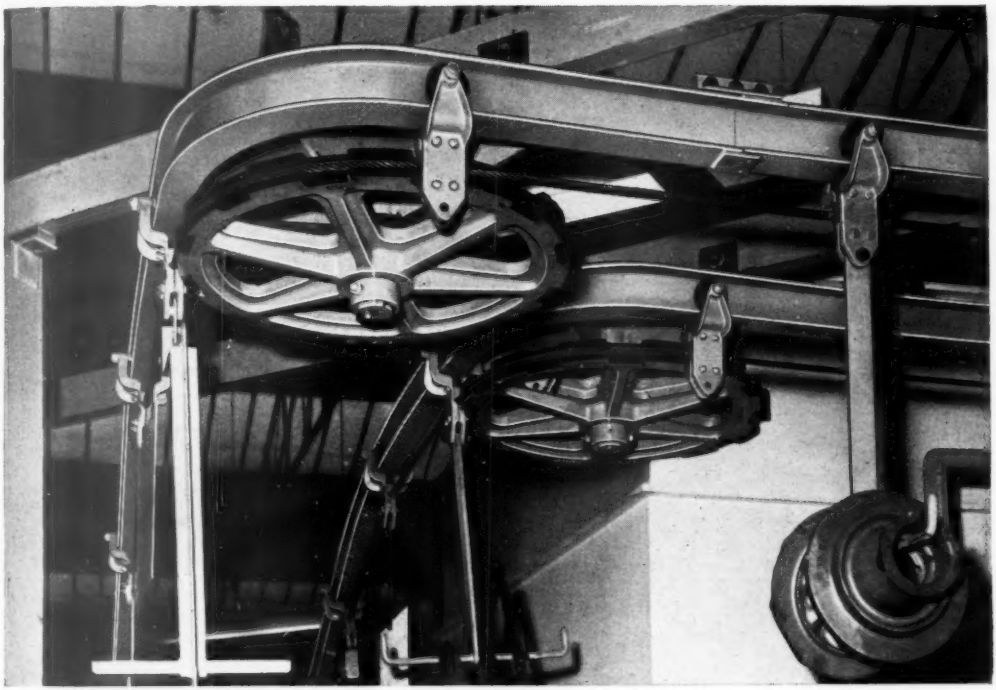
WIRE ROPE CONVEYOR

PATENTS APPLIED FOR



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New Patents

(Copies of complete specifications are obtainable from the Patent Office Sales Branch, 25, Southampton Buildings, Chancery Lane, London, W.C.2, price 5s.)

762,235. Manganese Bronze & Brass Company, Limited, 63, Grosvenor Street, London, W.1.

New aluminium-bronzes which show a marked resistance to corrosion, especially to attack by moving sea water. A typical composition would be aluminium 8 to 10.5, nickel 0 to 3, manganese 0.5 to 8, iron 4.5 to 10, zinc 0.5 to 2.5 per cent. Copper and incidental impurities constitute the remainder. The iron content should be at least three times the nickel content when nickel is present.

762,311. Continuous Casting Company, Limited, 17, Victoria Street, London, S.W.1.

Improvements in tundishes. The tundish claimed consists of an open-topped well connected to a discharge orifice(s) by one or more tubular passages. Each passage has its outlet end at a higher level than its inlet end in the working position, of the tundish, so as to prevent liquid metal flowing out of the outlet end, except when the inlet end is wholly submerged by liquid metal in the well.

762,356. Demag A.G., 64, Werthauser Strasse, Duisberg, Germany.

A process for the production and refining of iron or steel, in which, during the whole process, the melt is maintained substantially free from substances which contain aluminium or aluminium compounds.

762,469. Marvin J. Udy, 546, Portage Road, Niagara Falls, N.Y., USA.

An improved process for the production of ferromanganese.

762,482. A. J. Moore, 4, Purley Bury Close, Purley, Surrey.

Apparatus for low-pressure die-casting. The object of the apparatus is to hold down the thermal capacity of the ancillary equipment so far as possible so that the heat taken up by the ancillary equipment at the commencement of the entry of metal through the ingate of the die is reduced to a minimum.

762,513. Gebr. Bohler & Company, A.G., Elisabethstrasse, 12, Vienna, 1, Austria.

Guiding mechanism to be applied to a continuous-casting product as it emerges from a short chill mould. The mechanism comprises guiding surfaces pressed by means of springs against the cast product in a direction perpendicular to the surface of the latter after it leaves the chill mould. These guiding means are made of a material which is a good conductor of heat. Means are also provided for cooling the guiding surfaces.

762,524. Lion Foundry Company, Limited, Kirkintilloch, nr. Glasgow, Scotland.

A method of making a hollow casting by centrifugal means. An expandible sleeve is exerted into a permanent tubular mould. Into the sleeve is fitted a detachable, shaped metallic mould which forms the outer boundary of a die cavity. The inner boundary is defined by an internal sand-core spaced at least in part from the shaped mould. A space is thus left to receive the molten metal. The molten metal is then subjected to a centrifugal casting operation. The mould is then removed and the casting extracted. The shaped mould is thus re-usable for further casting.

762,542. Compagnie Industrielle Savoie-Acheson, 12, Rue de Général Roy, 8eme, Paris, France.

A method of introducing solid or pulverulent reagents in a liquid metallic bath. The reagent is contained in a cartridge composed of a material which will disintegrate or become rapidly dissolved in the bath. The cartridge is injected into the bath by forcing it down a tube immersed to the required depth in the bath.

762,545. Electric Furnace Products Company, Limited, Canada Life Building, Toronto, Ontario, Canada.

Nickel-base alloys and improved nickel/silicon alloys. A typical composition would be silicon 4 to 10, tantalum 2 to 25, copper 0 to 4, and iron 0 to 15 per cent., the remainder being nickel and incidental impurities.

762,590. Rem-Cru Titanium, Inc., Midland, Pennsylvania, USA.

Titanium-base alloys containing at least 50 per cent. titanium and also binary alloys of titanium and antimony. The patent also deals very thoroughly with ternary and higher component alloys formed by additions of other elements including alpha-promoting, beta-promoting, and compound-forming elements.

762,652. Chromium Mining and Smelting Corporation, Limited, West Queen Street, Sault Ste Marie, Ontario, Canada.

Improved metallurgical methods and processes including vacuum metallurgy. It also provides some interesting and novel processes employing sealed retorts and furnaces and associated equipment capable of establishing within the retorts temperatures high enough to promote metallurgical reactions for producing base metals.

762,741. General Motors Corporation, Grand Boulevard, Detroit, Michigan, USA.

A core assembly for use in casting a cylinder head of an internal-combustion engine. It comprises a water-jacket core having a number of openings in one side and a number of recesses in the other. An exhaust port core is provided with a number of generally laterally extending exhaust-port defining portions extending within the opening. It also has an intake port core which, similarly, has a number of generally laterally extending intake-port defining arms fitting in the recesses in the water-jacket core.

762,917. F. Nielsen, 12, Fichtenweg, Muhlacker, Wurttemberg, Germany.

This patent is a modification of No. 690,790. It concerns the casting of light metals. The metal to be cast is guided by an open gutter from the end of the inlet to the gate. By means of at least two deflections, or other energy consuming processes, preferably having a shock effect, the initial energy (*i.e.* the sum of the velocity energy and the pressure energy) of the metal being poured is destroyed to such an extent, and the gutter cross-sections are widened in stages in such manner, that the energy of the metal being poured, on entering the casting mould does not exceed 25 per cent. of the initial energy.

THE FIRST SOCIAL EVENING of the newly-formed London section of the Birmingham College of Technology Guild of Associates will be a dinner at the Ley On, Chinese restaurant, 91, Wardour Street, London, on Friday, March 1, 1957. Tickets, price 15s. each, can be obtained from Mr. T. O. Young, 32, Braham Gardens, Earls Court, London, S.W.5.